INFORMED PREFERENCES IN FOREST-BASED LAND USE PLANNING IN INDONESIA

A Methodological Case Study

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ABSTRACT

Indonesia is large and rich in natural resources. Its forest extends over 60 per cent of the country's land and contains many other natural resources. There are many stakeholders, often with conflicting interests. The demands placed on the forest have resulted in declining quantity and quality of the forest lands. People have recognised the need for reviewing and improving the forest-based land use plan, and, in so doing, promoting the participatory approach rather than the traditionally centralistic one. This has been attempted, but there were difficulties in the participatory evaluation of land use options' impacts. Therefore, this study aims to develop a method to help forestry-based land use planning take into account stakeholders' preferences after considering land use scenario consequences.

Based on the situation in Indonesia and existing options, this study adopted the mixed rational-participatory approach. The rational side was attempted by FOLPI simulation of land use scenarios. An interview survey of opinions suggested eight scenarios of varying emphases on the economic, ecological and social aspects, which were simulated in FOLPI with area and resource data of each land use. The results were graphs of land use changes and their economic, ecological and social impacts.

The participatory aspect was promoted by Q methodology applications. Q was used to analyse respondents' sorts of a set of statements about different aspects of land use planning, and revealed the typology and preferences of stakeholders with regard to land use planning. Using verbal statements in such exercises discovered the typology and normative preferences, while using the FOLPI application graphs as the statements disclosed the positive preferences. In tandem, they provide useful information as inputs to stakeholder deliberations towards a new, rational, and acceptable land use scenario.

This study, therefore, recommends a method to help forest-based land use planning stakeholders. The method includes FOLPI simulation of the broad-scoped land use scenarios, and Q applications both the conventional verbal way and the innovative graphical way.

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CHAPTER I
INTRODUCTION

A. Introduction

This introductory chapter presents the reason this study is undertaken, the identification of the problem to be solved and the aim to be pursued, as well as the general approach followed. The situation in Indonesia that was the background of this study is described briefly, to identify the need to undertake this study. (A fuller account of the background is presented in Chapter II, for the purpose of devising the tools to be used in this study to achieve the aim.) The background description is crystallised in a problem statement, which logically leads to the statement of the aim. Finally a sketch of the approach adopted in this study is presented.

B. Background

Indonesia is a large country that is rich in natural resources, but conflicting interests of different stakeholders have caused inefficient resource management which endangers the resource sustainability. The country produces, among other resources: oil, natural gas, minerals, and timber. The forest resources are important in the country because they extend over nearly 120 million hectares or 63% of the country's land (Pagiola 2001) and they contain the other natural resources mentioned above. In addition, the forest land itself has always been a land reserve for a growing population (Donner 1987). Many other land uses, such as agricultural plantations and shifting cultivation have been established on former forest lands. The different services of the forest have drawn many interests, which are often conflicting and prevent the resource management being efficient.

Continual disturbance has rendered the quantity and quality of the forest questionable. There have been different estimates of the extent of deforestation in Indonesia, ranging from 263,900 ha to 2,400,000 ha annually according to the review by Sunderlin and Resosudarmo (1996). A confirmation may be found in the figure that was reported online by the Indonesian Ministry of Forestry, i.e., 1.8 million ha/year (Indonesian Ministry of Forestry 2000). In terms of the causes, Contreras-Hermosilla

(2000) distinguishes direct causes from underlying causes. Direct causes are the apparent actions by agents who directly convert forested lands to other uses or reduce the forest's productive capacity. They are influenced by indirect causes, such as mistaken policy interventions, population growth, market failures, etc. Sunderlin and Resosudarmo (1996) noted that there had been a shift in the blame from direct causes, especially the smallholder agents, towards the underlying causes.

Thus, different agents come to disturb the forest for different reasons and the major ones are miners, loggers and rural communities (Contreras-Hermosilla 2000). A more detailed stakeholder identification was carried out by the Indonesian Ministry of Forestry (2000), which classified the agents into Government, Business, and Community interests. Government includes central, provincial, district and village levels, and covers the executive, legislative and judicial. Business interests are those of private and state companies, be they small, medium or large companies. The community interest covers local communities, customary-law communities, impact-affected communities, NGOs, scientific communities, international communities, consumers, journalists, political parties, professional associations, etc. Many of them try to reap benefits from the forest, often with little consideration of its sustainability. The recent social and political changes after an economic crisis had aggravated the problem, as the government loosened control and the many other stakeholders took advantage of it.

The situation is often aggravated when motivations conflict, which leads to social tension. Fraser (2002) draws experience from the Joint Forest Management in India and the Model Forests in Canada, and suggests that stakeholder participation, as adopted in these two examples, would solve many conflicts. As he notes (p.179):

> The examples show that creating institutional mechanisms to allow such communities to participate in the decision process relating to the management of the forest resources can reduce conflict, without seriously compromising the commercial use of the resource. It may mean that the revenue generated from harvesting is shared among stakeholders, rather than all being appropriated by government and commercial operators, but this brings more of the benefits that accrue from forest management to local communities, and gives them more incentive to protect the resource.

This stance is in line with Lin (1998: 168): "No matter how technically efficient or scientifically brilliant a policy may be, it needs the support and cooperation of stakeholders to be implemented."

The widely acknowledged forest decline raised awareness that a new approach to land use planning was needed. It was also realised that the participatory approach needs to be incorporated in the new land use planning. This actually has been attempted. For example, in 1999 the Indonesian Ministry of Forestry established a multi-stakeholder forum to devise a proposed national forest programme and the consultation mechanism (Indonesian Ministry of Forestry 2000). The forum suggested that the consultation process be bottom-up, and they created a few national land use scenarios to substantiate the consultation process. They wished they had been able to take into account the impacts of the scenarios.

The forum's consultation process was lengthy and laborious. In order to come up with the above recommendations, its task-forces had to meet more than ten times each, with the duration ranging from one half day to three days. It was difficult to reconcile stakeholders' positions as there was no systematic understanding of the stakeholders' preference. Such situations also existed at the provincial and district levels, and in several areas there had been similar efforts to revise the provincial or district land use plan.

C. Problem Statement

Indonesia has a large area of forest, on which many other land uses are dependent. In many areas, forest land use planning means regional land use planning. Unfortunately, the forest in Indonesia continues to decline. Different agents approach the forest with different motivations, and many of them reap benefits often without much consideration of the resource sustainability. This has been aggravated by the economic crisis and forest resources have declined both in quantity and quality. They need better management through improved and effective land use planning in order to prevent the damage from going beyond recovery. The Government has the authority and responsibility, but it cannot solve the problem without stakeholders' participation.

Experience with multi-stakeholder land use planning exercises in Indonesia shows that such processes need support. First of all they need a method to understand and consider different impacts of land use scenario. Secondly they need a method to understand the wider scale stakeholders' opinions on the scenario while considering the impacts. The combination should discover stakeholders' informed preferences, which are expected to help develop a sound and acceptable land use scenario.

D. Aim

This study aims to develop a method to help forestry-based land-use planning take into account stakeholders' preferences.

E. Delimitations

There are issues of scope that need emphasising in this study.

a. This study is not meant to cover the grand scope of land use planning. Land use planning is a complex issue. In addition to it being infeasible for this study to cover the whole scope, the background situation did not indicate the need for that. Rather, some problems within the scope of land use planning were identified and their solution is pursued in this study. The two land use planning elements targeted in this study are the evaluation of the impacts of land use scenario, and the understanding of stakeholders' preferences.
b. This is a methodological case study. It is a process to develop a method. The process involved some field trials of some methods, which became the basis to recommend the resulting method.

F. Approach

In order to achieve the above aim, Chapter II reviews in greater detail the situation of forestry based land use planning in Indonesia. It also evaluates the options available in the literature regarding experience already gained in similar situations. Based on this chapter and Chapter II, Chapter III develops the methodology adopted in the study for achieving the aim. First, it identifies the research questions to be answered in order to approach the aim. Then it selects the suitable methods to answer the questions. The selections are reasoned, and then the methods are briefly and generally described before the specific application in this study is laid down.

Chapters IV to VII present the results of the application of the methods. Chapter IV presents the application of land use scenario modelling using computer simulation. Chapter V presents the application of Q methodology for understanding stakeholders' opinions about land use planning in general, along with the consequences. Chapter VI also contains a Q methodology application, this time using graphs of land use changes and the consequences. Chapter VII draws lessons from the two applications of the same

method, but with different tools. The concluding chapter summarises the key points from all the earlier chapters, puts them in the whole context of the study so they become meaningful, and finally draws the conclusions, which are followed by some recommendations. The recommended set of steps to solve the above stated problem is also presented in a flow chart which appears as Figure VIII-1 in the concluding chapter.

CHAPTER II
CONTEXT

A. Introduction

As promised in the introductory chapter, an expansion of the background of the study is presented here. More detailed information on the Indonesian situation is necessary as a contextual basis to develop the methodology to achieve the aim. The natural resources that are the source of conflicts are described, including the forest lands and their management.

The other contextual basis for devising the methodology is the review of land use planning. This covers existing approaches and principles in this field. With the view to drawing lessons to achieve the aim of this study, the advantages and disadvantages of the approaches are reviewed. These pieces of information will be referred to in Chapter III, to be weighed in terms of their suitability for the problem situation in hand.

B. Indonesia and its Forest Land Management

In order to provide the context for developing a method for land use planning in forest rich areas in Indonesia, this section presents background information on the geography, natural resources, land use structure, and forestry in the country.

1. Geography

The biggest archipelago on the Earth, Indonesia has 17,508 islands with 81,000 kilometres of coastlines, spreading over 5,200 kilometres west to east and 1,900 kilometres north to south (Donner 1987; Indonesia National Development Information Office 1996; Kahar et al. 1997). Of the total number of islands, 6,044 are believed to be inhabited, but only about 3,000 are substantially settled. The land area forms only 37% of its economic territory, and yet it amounts to over 1.9 million square kilometres. This is eight times bigger than the United Kingdom, or seven times bigger than New Zealand.

Being tropical and right on the equator, Indonesia's climate is high in moisture, rainfall and temperature. The annual rainfall is generally between 2,000 – 4,000

millimetres, though in some extreme areas it can be as low as 500 millimetres and as high as 7,000 millimetres. Temperature is generally stable between $30^{\circ} - 34^{\circ}$ Celsius at sea level, but the high areas are relatively chilly, as they can be over 5,000 metres above sea level and covered by snow and glaciers. Generally the humidity is uniformly over 80 per cent, varying up to 100 per cent at night and 30-55 per cent at midday (Donner 1987; Cubitt et al. 1992; Indonesia National Development Information Office 1996).

The population in 1971 was 119,208,229 with an annual growth rate of 2.31. In 2000 it reached 206,264,595 with the growth rate declining to 1.49. Applying this growth rate gives an estimate of 222,096,110 for 2005. The population is not spread evenly across the country. In Papua Province the population density in 2000 was only 6 people per square kilometre, while in West Jawa Province it was 1,033 people per square kilometre (Statistics Indonesia 2005).

2. Natural Resources

Indonesia is relatively rich in natural resources (Indonesia National Development Information Office 1996). They are presented in Table II.1, excluding forest resources, which are elaborated separately, further below. Most of these natural resources are located in the forest lands or former forest lands, which are the natural vegetation cover on most parts of the country.

3. Land Uses

The land use of Indonesia is divided into the Jawa-Madura-Bali, and the Outer Islands (Donner 1987; World Bank 1994). While the land of Jawa is only 13.3 million ha, or 7 per cent of the national total (Pagiola 2001), its population in 2000 was 131,352,608, or 58.8 per cent of the national population. This imbalance of population has led to a dichotomy in land use structure. Given the enormous population living on the relatively small island, it is only logical that the forest area has been pressured and reduced to just 1.2 million ha, or 9 per cent of the land (World Bank 1994; Pagiola 2001). On the contrary, the Outer Islands forest was 118.5 million ha or 67 per cent. This dichotomy was also the reason for this study to delimit the land use scenario study to the forest-based area.

Table II.1: Natural Resources of Indonesia, excluding forest products

Resources	Production/Reserve	Notes
Oil	• 60 Sedimentary basins • 66 billion barrels oil equivalent	•
Liquid Natural Gas (LNG)	• 266 trillion cubic feet (tcf) reserve • 155 tcf proven recoverable	• World's biggest export
Coal	• 36 billion tons reserve	• High quality (1 per cent ash)
Tin	• 30,000 tons production in 1995	• One of the world's largest producers
Copper	• 1.7 billion tons reserve • equivalent to 39 billion pounds of copper	• Reserves at Freeport's mines in Papua alone.
Nickel	• million tons nickel ore production in 1995 • 24,000 tons of ferro-nickle	•
Bauxite	• 1.1 million tons of ore production in 1995	•
Gold	• 45,272 kg output in 1995; • reserve: 47.6 million troy ounces	•
Silver	• Reserve: 108.5 million troy ounces	•
Rubber	• 1.5 million tons output in 1995	• World's second largest producer
Sugarcane	• 2.34 million tons production in 1995	• All for domestic consumption.
Coffee	• Export ranging 250,000 – 415,000 tons from 1990-1995	• World's third largest producer • a major exporter.
Palm Oil	• 544,000 tons of palm kernel in 1995	• Second to Malaysia in production
Tea	• $ 85.4 million export in 1995	•
Cocoa	• $ 224 million export in 1995	•
Spices	• $ 214 million in 1995	• One of the world's largest suppliers

The more detailed land use structure of Indonesia basically is affected by the above dichotomy. In Jawa the urban areas are 14 per cent of its total land, while in the Outer Islands it is 2 per cent. Similarly, the tree crops percentage is higher in Jawa than in the Outer Islands. The whole land use structure for both, as well the whole of Indonesia is presented numerically in Table II.2 and visually in Figure II.2. They show that most area in Indonesia is still dominated by forests and other extensive land uses. The more intensive land uses are found mostly in Jawa.

Table II.2: Land Use in Indonesia (million hectares)

Land Use Type	Jawa		Outer Islands		Indonesia	
	Ha	%	Ha	%	Ha	%
Forest	1.2	9	118.5	67	119.7	63
Bush/Scrub	1.4	11	17.3	10	18.9	10
Grassland	0.1	1	10.2	6	10.3	5
Shifting Cultivation	0.3	2	11.4	6	11.7	6
Upland	2.3	17	3	2	5.3	3
Wetlands	3.4	26	4.5	3	7.7	4
Tree Crops	2.4	18	5.5	3	7.6	4
Urban Areas	1.8	14	2	1	3.8	2
Other	0.5	4	5.5	3	6.0	3
Total	13.3	100	177.6	100	190.9	100

Source: Recalculated from Table 2.1 in World Bank (1994) and Table 4.1 in Pagiola (2001)

There are at least 12 institutions involved in land management in Indonesia, according to the World Bank (1994). The two major ones are the National Land Agency which is 'responsible for land titling and registration, as well as management of state land and some land use planning' (World Bank 1994: 37) and the Ministry of Forestry, which controls all forest lands. The others include extensive land users such as the Ministries of Agriculture, Transmigration, and Public Works, and those responsible for

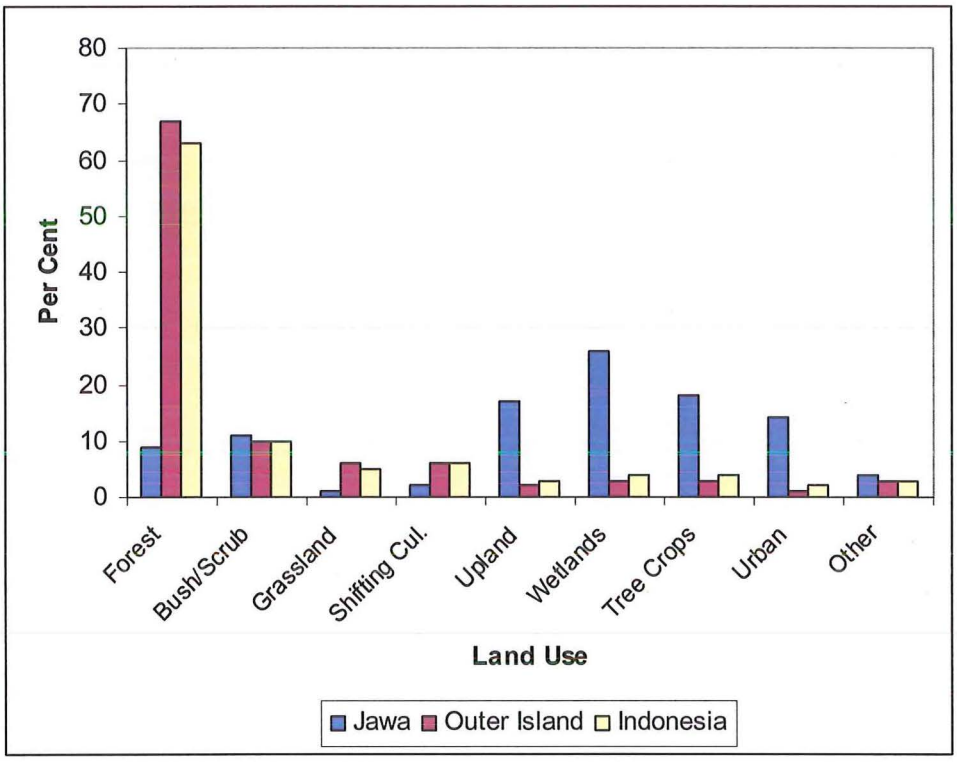

Figure II.1: Land Use Structure of Jawa, Outer Islands, and Indonesia

certain aspects such as the Ministry of Environment, Land Survey Agency, and Investment Agency. Coordination among these institutions is not easy in Indonesia. The decentralisation, which has been introduced recently, has brought new players into the land use planning in the country. As the Decentralisation Act 22/1999 stipulates that districts have the power of forest resource management, some districts interpret it as a power of land use planning as well . The Forestry Act 41/1999 that came later, however, maintains that the power of changing the forest land use remains with the Minister of Forestry. This issue has continued to be a power battle between the central and district governments.

4. Forest Resource Management

a) Resources

An early assessment of the natural forests in Indonesia was carried out in the early 1980s, with the formalization of the Consensus Forest Land Use. It must be noted, however, that this planning document is often inconsistent and inaccurate (Seve 1999). It originally covered 143.7 million hectares of forest lands. This figure was updated to

140.4 million hectares in 1994, comprising 30.7 million hectares of protection forests, 18.8 million hectares of conservation areas, 64.3 million hectares of production forests, and 26.6 million hectares of convertible forests. These figures in 1999 gave a total of 121.1 million hectares, with the components respectively 33.9, 20.6, 58.5, and 8.1 million hectares (Indonesian Ministry of Forestry 1997; Indonesian Ministry of Forestry and Estate Crops 1999). The last available update was in 2002, in which the total forest land area was 120.35 million ha (Indonesian Ministry of Forestry 2002). The reduction of the forest area was partly intentional, for various non-forestry development purposes.

In order to evaluate the quality of the forest lands, a closer look was taken in 2000 with the recalculation of the natural production forests, protection forests and conservation areas (Ministry of Forestry and Estate Crops, 2000), which covered 46.9 million hectares of production forests and 29.79 million hectares of protection forests. Of the production forests, the 41.1 million hectares of existing concession forests were classified into 45% virgin forest, 27% average/good secondary forest, and 28% degraded forest, bareland, agricultural land, etc. The corresponding breakdown of the 5.7 million hectares of ex-concession forest was respectively 11%, 44%, and 45%. The recalculation of the protection forest and conservation areas showed that 58% was primary forest, 22% secondary forest, and 20% not forested. The quality reduction of the forest resources was due to many causes, including fires and illegal timber extraction.

With the growing recognition of the increasing wood demand and with limited supply from the natural forest, planted forests are becoming more important. However, of the targeted 9.2 million hectares of new plantation, only 2.3 million hectares have been established so far (Indonesian Ministry of Forestry 2002).

b) Forest Administration

The institutional aspect of the management of public forests – which include all long-existing forests – has been quite dynamic since forests gained economic importance in Indonesia. In the central government the forest authority has changed from a directorate general in the Ministry of Agriculture until 1983, to a Ministry of Forestry until 1999, then it merged into the Ministry of Agriculture and Forestry, into a Ministry of Forestry and Estate Crops from early 2001. The last change took place in 2002, when once again it has become a Ministry of Forestry.

As at the regional level, the provincial office of the Ministry of Forestry was to ensure application of national forest policy while the provincial governments were in charge of policy implementation. Some redundancy was recognized then, and recently a solution has been attempted through the adoption of a decentralized government system. Under the new system the Ministry's provincial offices were merged into the provincial government offices. At the field level, forest operation under concession has always been implemented by private companies and state companies.

The silviculture aspect of forest management in Indonesia is not as dynamic. Since the beginning of the use of natural forest, the government has instituted a cautious measure by developing an Indonesian Selective Cutting System *(TPI)*, which has been made even more conservative through its improvement into the Indonesian Selective Cutting and Planting System *(TPTI)*. The system involves a standard harvest every 35 years (Ministry of Forestry, 1997), allowing cutting of only commercial trees with a diameter at breast height (dbh) of 50 cm or more, with the condition that the remaining stand must have at least 20 future trees with dbh of 20 cm or over. Assuming a diameter growth of 1 cm per year and 3 m^3 per year per hectare, the system produces the same level of yield in each cycle. The application of these prescriptions requires much control, the capacity for which is lacking.

c) The Multidimensional Crisis

Indonesia was not the first, but was the country worst affected by the Asian economic crisis from 1997. While Thailand and the Philippines were earlier troubled (Mulyani and Winoto 1998), in Indonesia the economic crisis has been prolonged and has expanded into social and political crises. The collapse of the nation's economy was depicted by the depreciation of the rupiah by 80%, market capitalisation of the Jakarta Stock Exchange at about 10% of pre-crisis levels, real growth of minus 15%, inflation of over 60%, and high unemployment and underemployment (Fisher 1998). The World Bank was quoted as noting that: "No country in recent history, let alone one the size of Indonesia, has ever suffered such a dramatic reversal of fortune" (Sunderlin 1999). This caused the fall of the government and succeeding governments have focused on improvement of democracy and less on the social-economic aspect.

d) Impacts of the Crisis on Forestry

Forestry is among the sectors directly affected by the crisis. Forests in Indonesia host, or are adjacent to, a great number of poor villages. As life becomes more difficult due to the currency depreciation and price increase, people are tending to make more use of the forest resources, especially as the government's control over the resources is loosened as a consequence of its focus on improving the political system. Sunderlin (1999: 1) identifies the following impacts of the crisis on forestry:

- Two-thirds of the people in forested areas have become worse off during the crisis compared with their situation in the year before the crisis;
- Small farmers are increasingly interested in clearing forests for perennial tree crops rather than raising food crops in shifting cultivation systems;
- Pulp and paper have replaced plywood as the mainstay source of export revenue in the forest sector, although the origins of this transformation pre-date the crisis and the change cannot be solely explained by the crisis;
- Illegal logging has boomed during the crisis, but also cannot be entirely explained by the crisis;
- Oilpalm development has slowed in the crisis period but is poised for future growth;
- Positive forest policy changes have been introduced but in general fall short of the expectations of the reform community in Indonesia.

In addition to the above, the decentralization scheme, which was expedited in an effort to reduce the social and economic crisis, has dual impacts. With the transfer of responsibilities and authorities from the central to the local governments, there is a possibility for some local governments to see the natural resources including forests as an immediate financial source to attempt development during the crisis. The other impact is that under a decentralized government, more stakeholders in forestry at various levels are involved in the decision making concerning the forest. This increased involvement should be favourable in terms of forest stewardship, against fires for example. However, multi-stakeholder decision making, especially when newly practised, is a long and difficult process.

e) Efforts Taken

To cope with the changed situation, a number of efforts have been taken by the government. The above mentioned decentralization scheme has been formalized in Act No. 22/1999. In the forestry sector, The Forestry Act No 5/1967 has been revised as Act No. 41/1999. This new act adopts a more decentralized system of forest administration, and better accommodates the role of communities in forestry. Under the decentralized system, the main function of the central government in the management of natural resources is to guide and control the local governments, which carry out the management of the forest resources.

In line with the international efforts in the management and conservation of the forests, the Indonesian government has taken steps to develop a National Forest Programme (NFP). NFP is "a comprehensive forest and estate crops policy framework for the achievement of sustainable forest management, based on a broad inter-sector approach at all stages, including the formulation of policies, strategies and plans of action, as well as their implementation, monitoring and evaluation" (Consultative Group on Indonesian Forestry 1999: 4). As an exercise in the development of the NFP, two multi-stakeholder task forces - the NFP Scenario Task Force and the NFP Process Task Force - were established in 1999 and completed their task in May 2000. The Scenario Task Force recommended five scenarios for discussion during the consultation process (Scenario Task Force 2000). Intuitively the multi-stakeholders task forces have attempted to put quantitative measures in the scenarios, as summarized in Table II.3. The total acreage and the proportion of the forest functions, however, does not reflect the respective name of the scenario without the accompanying narration.

The NFP Process Task Force recommended that the consultative process of the NFP development starts from the local level and scales up to the national level (NFP Process Task Force 2000). This implies the importance of empowering local institutions in developing a forest land use plan. Such an approach is in line with the international recommendation on the way to resolve social and economic conflicts related to sustainable management and use of forests (Elsasser 2002).

Table II.3: Five scenarios generated by the NFP Task Force

No.	Name	Forest Area (million ha)	Protection (%)	Conservation (%)	Production (%)
0	Status quo	Continuous degradation	changing	changing	Changing
1	Forest for people	90	30	20	50 (forest plantation, agroforestry, unproductive areas)
2	Forest for wood industry development	110	30	20	50
3	Forest for economic growth	100	30	30	40
4	Forest for social equity	110	30	30	40

C. Land Use Planning

1. What is it?

According to FAO (1993: 1), land use planning is "the systematic assessment of land and water potential, alternatives for land use and economic and social conditions in order to select and adopt the best land-use options." This implies a purpose to select and put into practice land uses that best meet the needs of the people while maintaining the resources for the future. Such a purpose should be driven by the need for a change due to changing situations.

In its definition, GTZ Working Group on Integrated Land Use Planning (1999: 1) emphasised on the participatory process:

> Land use planning is an iterative process based on the dialogue amongst all stakeholders aiming at the negotiation and decision for a sustainable form of land use which is acceptable as far as the social and environmental contexts are concerned and is desired by the society while making sound economic sense.

The working group believes that the definition contains the basic elements that are required for the achievement of sustainable development, i.e. the land use should be acceptable in the social and ecological context, and is desired by the society while

making sound economic sense. The working group further notes that "the objective of land use planning is to create the prerequisites to achieve a land use which is sustainable, socially and environmentally compatible, socially desirable and economically sound" (GTZ Working Group on Integrated Land Use Planning 1999: 7).

2. Forest-Based Land Use Planning

Forest is typically an extensive land use, and was originally the natural vegetation cover on most parts of the Earth. The extent of the forest, however, has generally declined under the pressure of population and economic growth (FAO 1997). In the developing countries the decline is continuing at an alarming rate, nearly 200 million hectares from 1980 to 1995 (FAO 1997). On the contrary, the developed countries are now reversing the trend through afforestation and reforestation at a rate of 20 million hectares during the same period. Nonetheless, forests still occupy a large area in many countries. In 1995 it was 23.2 per cent in the then 12 EU countries, 44.7 per cent in Canada, 32.5 in the U.S., 29.4 in New Zealand, and 60.6 percent in Indonesia (FAO 1997).

This large extent has given the forest a special place in land use planning, though the nature is different in developed and developing countries. In developed countries, the nature of the forests has caused its exclusion from land use planning. Developed countries commonly do not govern the location and design of new forests; rather, they leave them to be determined by commercial factors (Selman 1997). The situation is the opposite in developing countries, especially those still having a large extent of forest lands. In Indonesia, which has over 60 per cent of its land under forest land category, for example, forest lands have continued to dominate land use planning. This was shown by the Consensus Land Use Plan, which was agreed by many government sectors. It was essentially a land use plan for the country's rural areas.

The significant coverage has also made the forest's condition a major issue in the pursuit of sustainable development. In tandem with the extent, the forest also offers different economic, ecological and social benefits for mankind. Different stakeholders would attach different values to each of the benefits. The local people may emphasise the non-timber forest products and the ecological stability such as the availability of clean water. Business people logically would seek the economic rent of the forest. The government also needs revenues for running its administration, but at the same time, it

has the obligation to represent common interests, and so unlike the business people, it advocates for the long-term availability of the benefits. These different interests have brought about continual disturbances to the forest, which in turn call for amendment.

The importance of the forest and its adverse situation provide a paradox to the sustainability of the forest. This has driven the development of the total value or full value concept, which is now a central concept in forest management and forest land use planning (Buttoud 2000). The term 'sustainability' has long been a subject of disputes, but most parties have agreed on its three elements, namely the ecological, economic and social aspects. Approaches to the balancing of these three aspects have characterised the different approaches to forest land use planning.

5. Land Use Planning Approaches

Land use planning is an example of public decision making, to which there are a number of approaches.

a) Instrumental rationalist

This is often called the standard or traditional approach, which involves the public authority taking the decision for the society (Wood 1991; Buttoud 2000). The common interest is defined by rationalist norms without any formal consideration of the needs and interests expressed by the users. In forestry, it is even sometimes emphasised that the common interest is not only different, but also contrary to the social needs as expressed by the users (Buttoud 2000).

The decision is usually only one, which is the result of analysis by the analyst and adopted by the authority. The analysis usually involves the addition of all values attributable to each land use. These values may be directly measurable in market prices, or otherwise they are indirectly estimated. There is a difficulty with this method, as many values, such as aesthetic, pedagogic and cultural values, are impossible to be evaluated in monetary units.

Also, there have been criticisms of the process in this approach, as Wood (1991) lists. First, it lacks local participation. The government officials making the decisions are usually outsiders, and so are the analysts who provide technical assistance. The process makes little use of local knowledge and skills and relies on input contemplated in research stations. Second, emphasis on the relationship between land use and the

environmental characteristics of the area has caused neglect of the socio-economic and political factors at different levels. The third weakness is its limited replicability, because the analyst who assisted, or the funding scheme, may no longer be available. Last, the resulting plan is often difficult to implement without translation into more practical forms, which is rarely done.

b) Qualitative assessment

Considering the difficulty in the first approach, this one still adopts the total utility summation method, but it involves assigning quality scores to the component values of each land use. For example, each component value is ranked from 1 to 5. In this way, the method only classifies each land use relative to the importance of each utility function. It does not give any information about the value itself. This is, however, better than taking the decision in total darkness.

This approach has also been subjected to a number of criticisms (Buttoud 2000). First, the qualitative ranking is assigned subjectively and normatively. Second, the evaluation of the values is very likely debatable. Third, the weight of each value under evaluation is not known.

c) Communicative incremental framework

This approach is the response to the view that (Buttoud 2000):

> "In pluralist societies, the image of a unique public decision maker, who can be rational and able to solve all the problems for the well-being of the community that (she) he represents and manages as well on behalf of the common interest has become largely obsolete."

Under this newer approach, stakeholders directly express the common interest. The public norm is a social consensus, which is institutionalised by the authority. The authority has a more passive role than in the first approach, i.e. to derive a compromise out of various stakeholders' interests. It is a coordinating role towards a compromise of the opposing positions. "There is a participatory process of discussion and negotiation among the various parties interested, which results in one or several decisions compromising the various values expressed by the participants' positions in the discussion" (Buttoud 2000). There have been different methods of public participation, such as referenda, public hearing/inquiries, public opinion surveys, negotiated rule making, consensus conference, citizen's jury/panel, citizen/public advisory committee, and focus group (Rowe and Frewer 2000). Usually such approaches lead to bottom-up

and self-reliant policies. This approach has recently gained wide acceptance, partly due to its financial benefits. The consequences of policies that are unacceptable to the public include the costly conflict, delay, and litigation and the loss of different management resources (Steelman and Maguire 1999). This was also supported by Buchy and Hoverman (2000: 19), who noted that:

> "The appeal of participatory planning or management resides in the assumption that communities' views having been taken into account, the policy or the projects will respond better to real needs, will fit into a social and economic reality and people, feeling a sense of ownership, will be more compliant to bear the costs."

Among the criticisms of this approach that Buttoud (2000) lists, the first is that it is not guaranteed that all relevant components are expressed because only some identified and specified stakeholders participate in the process. Gregory et al. (2001) share this concern by saying that a poor quality of the decision making process may result in premature consensus which ignored important technical issues or facts. Apostolakis and Pickett (1998) also joins this club with his concern that in the participatory process "technical issues often fall to the wayside" (p.622). However, on this issue there is also oppositions, such as offered by Appelstrand (2002), who holds that the involvement of many stakeholders will help to create more informed decisions, "given the valuable lay knowledge and subjective perceptions the public can provide."

Another issue raised by Buttoud is that as the participants may be numerous and in opposition, there can be a number of contradictory issues. A rigorous technique for combining these needs much effort and time and in the end, it usually involves the exclusion of extreme positions for technical and political reasons. Another identified weakness is that because it involves deliberations, it depends on the behaviour of the facilitators. Also, there has been suspicion that the process can be used to endorse a preconceived result. For that purpose, important values may be hidden, either for technical or political reasons. Another of his criticisms, which is shared by Elsasser (2002), is that the process usually consolidates the positions expressed by the more organized representatives. In a formal debate, the more formal groups are much more prepared to defend their own solutions. The pluralist model does not automatically guarantee equity among stakeholders.

d) A mixed approach

Considering the drawbacks of the above-mentioned approaches, there have been attempts to combine them. This involves a logical rationalist sequence for identifying and classifying principles, objectives and means with a participatory approach. There is no attempt to calculate or estimate the full value of the resources. As the policy decision is based on the compromise raised from the expression of all the parties, it should eventually consider all the various values. At the end of his paper Buttoud (2000: 174) comes up with this recommendation:

> ... due to the present lack of knowledge, an objective can be to use both communicative incremental and instrumental-rationalist approaches, in a combined top-down and bottom-up procedure for policy decision-making. Ways to do this constitute a real challenge for research on forest policy for the years ahead.

The above classification of public decision-making approaches is equivalent to the one used by McCarthy (1996) to describe the practice in an urban area in London. He labels the approaches as 'trend planning', which is centralised and equivalent to the instrumental-rationalist, either the quantitative or qualitative. The second type is the 'popular planning', which is the equivalent of the communicative framework. The third is 'leverage planning', which combines the two.

GTZ Working Group on Integrated Land Use Planning (1999) also differentiates planning systems into three: central, decentralised, and heterogenous planning systems. Centralised planning systems are top-down oriented; lower administrative levels implement the directives of the central authorities. Decentralised systems involve the transfer of power and budget to lower administrative levels to encourage participatory decision-making structures. The heterogenous systems are mixtures of the two, i.e. at the central level the planning is centralised, while at the lower level different mechanisms are used.

6. Land Use Planning Tools

For the purpose of evaluating the tools which are used, the approaches could be distinguished into two opposing ones, i.e. instrumentalist-rationalist and participatory.

e) Tools for the Instrumental-Rationalist Approach

Given its reliance on the resource full-value concept, this approach favours the corresponding tool, i.e. the Total Economic Valuation (Buttoud 2000). This is the method of the utilitarian economic approach, which holds that the decision for land use conversion is determined by the relative profitability, or rate of return, of options. Cost-Benefit Analysis (CBA) is the common procedure for evaluating such profitability, into which the Total Economic Value (TEV) concept is commonly included in order to allow resource sustainability (Pearce et al. 1994).

A common taxonomy of TEV includes use values and non-use values (Pearce et al. 1994). Use values include direct use values (e.g. timber), indirect use values (e.g. protection by watershed), and option values (e.g. biodiversity). Non-use values include bequest values (knowledge that others might benefit from the resource in the future) and existence values (knowledge that the resource exists). These values are measured by direct market price technique, indirect market price technique (e.g. surrogate price, opportunity cost), and non-market price techniques (e.g. contingent valuation) (Gregersen et al. 1995).

The development of these methods was in line with the popularity of environmental economics, and boosted by the need to attach value to damages to natural resources. The famous one is the case of the Exxon Valdes tanker, which spilled oil into a sound in Alaska in 1989. Both Exxon and the governmental trustees for the resources damaged hired economic experts, and contingent valuation could no longer be ignored (Pearce et al. 1994).

However, non-market valuations have been criticised for depending directly on the validity of the neo-classical axioms of consumer choice theory, which are claimed as failing to confirm accepted models of human behaviours (Kant 2003). This is due to the assumption on invariance of preferences, non-satiation, a smooth and continued utility function, no distinction between needs and wants, and reducibility of all wants into money. In this regard, the supporters of neo-classical economics would argue that a sensitivity analysis could deal with the reduction of various values into single numbers. They hold that such reduction can represent broader stakeholders who tend to be excluded from the process, i.e. those who do not have a well-organized lobby or voice. Also, "CBA (with TEV) is readily supplemented with an analysis of effects on

competitiveness and employment, and modern practitioners of the contingent valuation approach emphasize its role in securing public participation" (Pearce 1998: 94).

f) Tools for the Participatory Approach

This approach generally uses methods and techniques that encourage public participation. GTZ Working Group on Integrated Land Use Planning (1999) identified methods that they found worked in the field. They advocated the use of methods and techniques under the Participatory Rural Appraisal (PRA) approach, and those that have developed from ethnographical, ethnological and ethno-ecological research, such as the indigenous knowledge approaches. In addition, they also encouraged division of areas into land units, and identification of agro-ecological zones (AEZ). These have to be recorded in a map. They also recognised the usefulness of the Geographical Information System, apart from its help in elevating the prestige of the project. They also put emphasis on the need to develop trust among all stakeholders, including through the provision of material incentives or non-material support. The analyst then prepares a proposed land use plan through consideration of a list of questions, which are mainly related to the practical implementation of the plan. Areas are evaluated in terms of their technical potential. Also considered are the socio-economic, socio-cultural and logistical aspects. Land use options are evaluated in terms of their economic viability and the level of restrictions due to the requirements. Subsequently the plan is presented in a negotiation and decision making process. Conflicts are expected to appear, which require proper management. It is suggested involving neutral mediators and the parties who are less able to express themselves should be supported.

g) Tools for the Mixed Approach

The FAO Guidelines (FAO 1993) provide a full description of the steps to be taken in undertaking land use planning. The guidelines appear to adopt the mixed approach, emphasising people participation, but also including steps to rationally evaluate different values of land use options. At one stage, they also adopt the qualitative approach, i.e. in the rank ordering of the options. The steps are listed below, along with a brief summary, if deemed necessary.

(1) Establish the goals and terms of reference. This could be based on identification of the problems that trigger the need to change the land uses. The benefits

sought from the changes can be specified as the goals. The terms of reference include anticipation of constraints, which guides the setting of the planning scope and period

(2) Organize the work (plan the planning).

(3) Analyse the problems. Further to the early problem identification in Step 1, the existing land use situation has to be analysed through identification of land units and land-use systems. Then the problems have to be identified, along with their causes. The necessary information can be collected from existing sources, or through rapid rural appraisal, remote sensing, field surveys, and talking with relevant people.

(4) Identify opportunities for change. Opportunities appear when there is a possibility of filling a gap recognised during the problem analysis using "untapped human and land resources, new technology and economic or political circumstances" (p. 32).

(5) Evaluate land suitability. This is done through comparison of requirements of land use types and the properties of the land units. This may involve the use of quantitative models and mapping.

(6) Appraise the alternatives: environmental, economic, and social analyses. This is the more technical test of the opportunities already identified. An e*nvironmental analysis* checks if the quality of life of the whole community is worsen off by a land use. An e*conomic analysis* would answer the question of whether a land use is the most profitable option, and where it is most profitable. This may involve such concepts as net present worth, benefit:cost ratio, internal rate of return, shadow pricing, etc. Scenarios are often used to ensure that options for the future are open. A s*ocial analysis* reviews the impacts of a change on different groups of people in such terms as: employment, income opportunities, land tenure, etc.

(7) Choose the best option. This is done by comparing the specified objectives and the perceived consequences of alternatives. The latter is the result of the earlier steps. An example is given, which involves evaluation of a number of criteria by considering a 100 score for the best achieving scenario in that criteria. After considering different weights for the criteria, the scenario's total score can be obtained.

(8) Prepare the land-use plan.

(9)Implement the plan.

(10) Monitor and revise the plan.

The guidelines also include some methods and techniques that may be useful, which include: information management, system analysis, geographic information systems, natural resource surveys, rural land-use analysis (farming system analysis, diagnosis and design, rapid rural appraisal), modelling, requirements for plant growth, and financial and economic analysis, decision making, and people participation.

Other guidelines on the more general subject of participatory planning, not specifically for land use planning, are also available. An example is the Decentralised and Participatory Planning which of the FAO (1995). It contains similar steps as the Land Use Planning Guidelines, with an added emphasis of promoting the role of local government and other local bodies.

D. Conclusion

Indonesia is a large country both in area and population, and rich in natural resources. Conflicting interests have caused inefficiency in resource management, which was aggravated by the economic crisis which started in 1997. Forest resources are declining at an alarming rate, leaving patches of cleared land with unclear future management. The need for a new approach to land use planning is recognised.

If Indonesia is to renew its land use plan, there are several approaches from which to choose. These include the functional-rationalist, the qualitative, the participatory, and a combination of them. Each has its own favoured tools, such as the TEV for the functional-rationalist approach and PRA for the participatory approach. The participatory approach has gained wider acceptance, which is indicated by its elaboration in the mixed-approach guidelines developed in FAO (1993). The guidelines provide a comprehensive set of steps to be taken in land use planning, and also the recommended tools for implementation.

All these pieces of information are useful for consideration in devising the methodology to achieve the aim of this study. Such evaluation will be presented in Chapter III.

CHAPTER III
METHODOLOGY

A. Introduction

This chapter presents the way the study deals with the problem presented in the introductory chapter and further elaborated in Chapter II. The background situation and context of Indonesian forestry and land use planning gave the foundation for drawing the aim of this study and its breakdown into some research questions. The same background was considered in selecting the corresponding methods to answer these questions.

This chapter first presents research questions that need to be answered in order to achieve the aim that was identified in Chapter I. For convenience the aim is presented again here. Next is some explanation on the selection of methods used to answer the questions identified. The chosen methods are then described, followed by a description of the way the methods were applied in this study.

B. Aim

The aim of this study is to develop a method to help forestry-based land-use planning take into account stakeholders' preferences.

C. Research Questions

The above aim was to be attained by answering the following three questions:

- How to quantitatively present land use plans and their consequences?
- How to understand the stakeholders' preferences on land use planning?
- How to use quantitative presentation of land use plans and their consequences for understanding stakeholders' preferences?

D. Method Selection

Before selecting the methods, the approach first needed to be selected. This was based on the context, which was provided in the previous chapters. Further exploration follows in order to find the suitable methods.

1. Selecting the Approach

A land use planning approach should suit the situation in Indonesia. The review in Chapter II shows that forest-based land use planning in the past used to be centralised. It was realised that the plan did not work as expected by the central government as lack of support from most other stakeholders had prevented the land use plan from being effective. This was partly due to the large extent of the country's forest, which had overwhelmed the Central Government's capacity to administer it alone. The economic crisis, which started in 1997, had expedited implementation of the decentralisation of government. In the forestry sector, the new Forestry Act also favours decentralised forest management and people participation. With regard to the land use planning approaches, this situation leads to the participatory approach.

Meanwhile, the NFP Task Force recommended that NFP scenarios be developed through a bottom up process of consultation with the stakeholders, and that in doing so a number of possible scenarios be presented along with their estimated consequences. This indicates adoption of the mixed approach. Stakeholders wanted to be involved as much as possible in the process, but at the same time they wanted to consider the rational values of different land use scenarios.

Applying this approach in Indonesia would have been facilitated by the FAO guidelines for land use planning (FAO 1993). However, there are some issues that need considering. The first issue lies in the implementation of the consultation process. As described in Chapter II, there have been concerns about the inequity of representation between the formal group and those unable to represent and defend their positions. In addition, the experience of the multistakeholder exercise with the NFP forum suggested that they would benefit from a suitable method to evaluate the values of land use scenarios from which they would like to choose. These issues have been brought to the selection of FOLPI and Q methodology, as discussed below.

2. Why Use FOLPI?

a) Need for Management Science.

As described in the background section in Chapter I, the initial drive to carry out this study was to help the stakeholders in Indonesia develop forestry-based land use planning. The multi-stakeholder task forces had created several land use scenarios, and wanted to consider the impacts in order to choose one. They found difficulties in doing that.

Quantitative presentation of land use scenarios and their consequences, and the subsequent selection among them are complex matters. A major cause of the complexity is the number of land uses involved. At any level of planning, from district to national levels, different sectors are involved such as agriculture, forestry, conservation, and mining, each likely to include several land uses. This is an example of a complex decision environment, of which "the consequence of a wrong decision is potentially serious" (Dykstra 1984: 1), and for which, recently, natural resource managers have increasingly relied on management science. The land use planning situation also meets the criteria listed by Anderson et al. (1991: 6) for use of the management science quantitative approach:

→ The problem is complex, and the manager cannot develop a good solution without the aid of quantitative analysis.

→ The problem is very important (for example, a great deal of money is involved), and the manager desires a thorough analysis before attempting to make a decision.

→ The problem is new, and the manager has no previous experience to draw on.

→ The problem is repetitive, and the manager saves time and effort by relying on quantitative procedures to make the routine decision recommendations.

Management science, often interchangeably called operations research, is a scientific approach to managerial decision making (Dykstra 1984; Anderson et al. 1991). The management science approach extensively uses quantitative analysis. The role of qualitative analysis becomes less, as the problem becomes more complex, because previous experience with similar problems is lacking and the necessary intuitive feeling has not developed.

There are many management science techniques. Anderson et al. (1991: 15) list twelve techniques according to their popularity in the following order: linear programming, simulation, network analysis, queuing theory, decision trees, integer programming, dynamic programming, non-linear programming, Markov processes, replacement analysis, game theory, and goal programming. Anderson also lists their ranking in terms of familiarity, in which linear programming and simulation are the top two. Garcia (1981) confirms that these two techniques are the most popular also among planners. They are considered in this study.

b) Considering optimisation

The basic yet most popular optimisation approach is linear programming. As Dykstra (1984: 15) notes, "Linear programming is the most widely used mathematical programming method, and it has been the most broadly applied of all management science techniques in natural resource management and related disciplines." While it has such a great reputation, it has some attributes that need attention.

An important attribute of linear programming is that it maximises or minimises the quantity of an object under a set of constraints. This was problematic in this study. The context was that the stakeholders wanted to learn about the consequences of land use scenarios and are not interested in maximisation or minimisation of a single quantity of object, be it revenue, wood, or others. They want to see the land use scenarios' effects on different aspects, not just one. This drawback is embedded in this group of single objective programming methods, including non-linear programming and integer programming,

In this situation, among the alternative solutions is to consider the other objectives as constraints. The expression of these objects as constraints, however, requires that a threshold be set. For example, if the object to quantify is revenue, and the biodiversity index is to be considered as a constraint, then we need to know how low the index goes. Asking stakeholders to decide this threshold alone might take many days of deliberation.

Another solution for multiple objective problems, indeed the most widely used, is the goal programming (Dykstra 1984). However, the problem is in how to compare different objectives, i.e. how to weight goals *a priori*. This is also found in many other

multiple objective or multiple criteria programming methods. Such a difficulty was expected to be acute if applied in this study.

Attempts have been made to rectify the difficulties of setting thresholds *a priori*. Interactive multi-criteria programming involves the steps of consulting the decision makers progressively. As Vincke (1992: 104) describes it, this type of method "supports the decision makers by enlightening them on what is possible, what are the consequences of a certain choice, how can an aspect be improved, and so on". The emphasis is on finding one best-compromise solution. Usually, initially an optimal solution to a single objective problem related to the original multiobjective problem is produced (Evans 1984). For example, in the STEM[1] method the analyst would do an initial optimisation and show the result to the decision makers. The latter would express some preference as to whether the result should be improved, and what criteria should be improved, and how much change is acceptable. A new single objective problem is set for the next iteration. The process continues until the decision maker is satisfied. The types of preference information from the decision makers could be a rank ordering of various outcomes, a selective adjustment or readjustment of aspiration levels, or tradeoffs in information. These are relatively easier than the *a priori* preference articulation.

However, in the context of this study, such preference elicitation as required in the above multi-criteria decision aids, either a priori or progressively, would still be unmanageable. As Evans (1984: 1273) notes, "many real problems are too large to solve using this approach". This is true in this study, with many different land uses being covered and numerous stakeholders being involved as decision makers. A more practical method was sought.

c) Considering Simulation

Given the complexity of the problem, simulation is given more consideration. As Anderson (1991: 580) puts it,

> A primary advantage of computer simulation is that it is applicable in complex cases where analytical procedures cannot be employed..... the larger the number of probabilistic components in the system becomes, the more likely it is that simulation will be the best approach.

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[1] STEM stands for STEP Method. It is a linear programming with multiple objective functions, developed by Benayoun, R., J. d. Montgolfier, J. Tergny and O. Laritchev (1971). "Linear programming with multiple objective functions: STEP Method (STEM)." Mathematical Programming **1**: 366-375. It involves multi-step consultation between the analyst and the decision makers.

Another advantage of the simulation approach is that it provides a convenient experimental laboratory. It is usually relatively easy to experiment with the model by asking "what if" questions. If we want to see the effect of a new rate of operational cost, for example, we simply need to put the new rate into the data file and rerun the model.

Compared to the optimiser, however, simulation has disadvantages, including the probability that it may not come up with an optimal solution to the problem. However, "the danger of obtaining bad solutions is slight if good judgment is exercised in developing and running the simulation model" Anderson (1991: 580). In addition, the disadvantage can be compensated for by an appropriate method for articulating decision makers' preferences. This is in line with Vincke (1992: 103):

> ... the choice of scalarizing function should preferably lead to simple formulas and calculation; indeed, that choice is much less important than the quality of the dialogue with the DM.

d) New Zealand Planning Tools

Computer technology development has boosted the availability of quantitative methods to decision makers (Anderson et al. 1991). This is also true in New Zealand, where in the last 35 years quantitative planning has evolved from manual procedures to computer modelling systems (Manley et al. 1991). In large scale forestry modelling, development since the late 1960s has culminated in two widely used modelling systems, i.e. the Interactive Forest Simulator (IFS) and Forestry Oriented Linear Programming Interpreter (FOLPI), both developed by Forest Research[2]. They have been widely used in New Zealand and Australia for a range of applications (Manley 1997).

The IFS (Garcia 1981) is a computer program for simulating forest plantation management, with the view to explore 'what if' questions. IFS needs specification of the initial state of the forest, and then specification of the harvest and planting strategy in each period (Manley and Threadgill 1991). The IFS is interactive, displaying the current status of the forest so that the users can explore cutting options for the period before choosing one. This simulator was widely used in the NZ Forest Service (Manley 1995).

FOLPI accepts problems in forestry terms, translates them into linear programming terms, solves them, and produces reports back in forestry terms (Manley et al. 1991). Its application is not limited to various forest management purposes, as

[2] The organization which is now called Forest Research (FR) used to be the Forest Research Institute (FRI). The main campus is located in Rotorua. FR is a Crown Research Institute (CRI). It used to be part of the Ministry of Forestry (MOF) and before that it was part of the New Zealand Forest Service (NZFS).

exemplified by its use for forest valuation, modelling of carbon sequestration and regional land use planning (Manley 1997), as well as integrated agricultural and tree plantation planning (Douglass 1995).

e) FOLPI for the land use scenario simulation.

While originally meant as an optimiser, like IFS, FOLPI can also do simulation. This could be done in FOLPI by controlling the model so tightly that it does not optimise but, rather, "evolves over time". Used in this way, FOLPI is not affected by the difficulty of optimising based on a common unit, such as currency in revenue maximisation. The resources can be in different units and the model will report on them in those units.

This allows two benefits to be envisaged. The first is that unlike the IFS, FOLPI can conveniently advance the simulation for multi periods with a single command. The other benefit is that it keeps the optimisation option open for applications when the land use planning stakeholders regard that sufficient data can be made available so that they can reach agreement on the single value that is the basis for optimisation.

f) How FOLPI works

A full description of FOLPI can be found in Garcia (1984) and Manley et al. (1991). A summary is also provided in Annex 1. Here, the matter is merely briefly reviewed in relation to its specific applications in this study. Being an optimiser, FOLPI maximises or minimises a product under a set of constraints. This means that as long as the constraints are met, the system will do all it can to get the highest amount of the product in the case of maximisation, or the lowest amount in the case of minimisation. For example, if the objective is to maximise revenue and forests with a certain specification are profitable, then FOLPI will cut the forest at the optimum rotation age as possible unless it is prevented by the model's constraints. In order to use FOLPI, three inputs have to be provided: data, objective, and constraints. The last two are really specifying the model.

The data consist of two types, i.e. area at the starting point, and yield tables. The yield tables contain data on any resources associated with the operation of each hectare of the area from year to year. The resources may be a management factor, such as cost or harvest volume, or unrelated to management, such as the carbon released because of the activity.

Users choose the objective from a list, which is either maximising or minimising a resource. There are two types of constraints and the first type is set by the user. For example, a constraint can prevent a harvested resource from declining throughout the planning period. The second type of constraint is embedded in the system for consistency purposes. For example, the total area harvested in a particular year must be the same as the total area of post harvest activities in the next year.

Users are required to provide these three types of input. The calculation, which once was laborious, is now facilitated by linear programming software in a matter of seconds. This allows the exploration of many "what-if" situations conveniently.

g) FOLPI application in this study

There are two specific features in the use of FOLPI in this study. The first one is the broad coverage of resources being modelled. As the name describes, FOLPI was originally devised for forestry management, with the areas identified for forest stands or aggregates of them. However, there have been applications that include non-forest areas. In a study on land use change in the New Zealand high country (Hock et al. 2001; Te Morenga et al. 2001), FOLPI was also used to model agricultural lands. Another such application was carried out by Douglass (1995), who covered different agricultural plantations in Malaysia.

In this case study, the coverage is even broader. It is a regional land use planning study, where among the land uses potentially affected by changes are natural forests, forest plantations, agricultural plantations, shifting cultivations, grasslands, and coal mining. These different land uses, or their sub-land-uses, were treated as croptypes. In the original application, a croptype is an aggregation of stands which may differ in age but are regarded as uniform in terms of future management and yield production (Manley and Threadgill 1991; Forest Research Institute 1993). Such treatment is possible as long as data on their areas and the associated resources are provided.

The second specific use was the simulation runs that were performed in FOLPI. To do these, the scenario models were constrained tightly by specifying what should happen to each croptype from year to year along the planning period. The implementation of the FOLPI application is reported in Chapter IV.

1. Why Use Q Methodology?

With land use scenarios and their consequences described quantitatively using FOLPI, a method needed to be selected for helping stakeholders make decisions on the preferred scenario. As mentioned in the consideration of optimisation above, the progressive preference articulation would not be suitable in this study, given the complexity of the case and the large number of stakeholders as the decision makers. A more practical approach was sought.

a) Preference articulation approaches

Approaches to learning about human preference can be categorised into two schools of thought, positivism and postpositivism (Durning 1999; Lynn 1999). Positivists usually apply surveys, while major postpositivist approaches include Q-Methodology, ethnographic methodologies, and participatory policy analysis methods such as science courts, scenario workshops, decision conferencing, citizen panels, citizen juries, and consensus conferences (Durning 1999). Ethnographic method-ologies were not likely to be suitable for this study, as they primarily use unstructured interviews and observation. The participatory policy analysis methods offer potential for the process of developing an acceptable land use scenario. Indeed, as described in the introductory chapter, the context of the study was that of a multi-stakeholder committee trying to develop a forest-based land use scenario through a series of meetings. Such a format was commonly used by planning teams in Indonesia, and is most likely to be used again in the future. This study was meant to facilitate such a process in achieving its objective by providing useful background information about stakeholders' preferences.

b) Q's convenient preference articulation

In this study, Q-methodology offers the potential to articulate stakeholders' preference more conveniently than the multi-criteria decision aids would do. In Q-methodology the subject's preferences are elicited through rank ordering a deck of cards. The first deck developed by the inventor of the methodology was of cards with a set of different colours, which were to be rank ordered from those they liked best to those they liked least. Though most subsequent applications use verbal statements, this methodology offers the opportunity to present to the subjects a set of cards with graphs describing land use scenarios.

Both types of Q statements could be used in this study, i.e. text statements and non-text statements. Used in tandem, they can provide a lot of information about stakeholders' preferences. The application with text statements could reveal opinions about land use scenarios in terms of the changes to the land and the impacts of such changes. The other application would present the scenarios in graphical formats. When the graphs were systematically designed, they would reveal stakeholders' favoured land use scenarios. More information from the Q application would come from the interviews that followed each Q sorting. These could be done in a relatively convenient preference articulation.

c) What Q-Methodology offers

The main strength of Q-methodology is rooted in its capability to correlate people, rather than traits. This is different from R-methodology[3], which correlates such traits as intelligence and weight. In this way correlations between people cannot be drawn because the traits are in different units. Intelligence is in an index and the weight is in kilograms. Q-methodology overcomes this by having people sort a set of items. Because the people assess the items using a similar scoring process, correlations can be drawn between the people. With the help of the factor analysis technique that has been used in R methodology, the groupings of people who sort in similar ways can be identified. For each grouping, a composite sort can be reconstructed. The groupings and the composite sorts are rich sources of information about the preferences that exist among the population. We can learn who are similar to whom, and what views they share. Also, we can learn what views are shared among different groupings, and what views are disputed.

Such information allows Q-Methodology to offer useful hints on stakeholder preferences prior to deliberative processes. Deliberation can be better managed with the knowledge of the types of stakeholders who make up each type, their preferences, and their reasons (Steelman and Maguire 1999; Addams 2000; Focht and Lawler 2000). This should alleviate the drawbacks of the deliberation technique. As the facilitators can better understand all positions existing among the stakeholders, including the silent ones, the chance for equity among them should increase. Such capabilities are potentially

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[3] The R refers to the Pearson's product-moment correlation, r, which has been predominantly used in the study of trait relationship (Brown 1980, Brown 1986, Brown 1997)

useful to help resolve conflicts which were pervasive in the context of the study. The situation is as Coke and Brown note (1976: 97):

> Attitudes toward property have always been fundamental in distinguishing political ideologies from one another, and no concept is more closely identified with property than land. The question of land use... has always been characterized by conflict....

While it has been applied mostly in developed countries and has never been applied in Indonesia, the methodology was deemed to have potential for the analysis of many problems in developing countries. For these reasons Q-Methodology is selected for application in this study.

d) How Q Methodology works

The methodology is thoroughly described in Brown (1980), and in briefer versions in McKeown and Thomas (1988) and Addams (2000). A technical summary is presented in Chapter V, and here the principles are briefly reviewed in relation to their application in this study.

As mentioned above, Q methodology generates information about people's preferences by correlating them in terms of their sorting of statements. This implies the following elements: a set of statements, a set of people, sorting and correlating (and further analysis).

The set of statements is elicited from the population, as far as possible. The most common method of elicitation is interviewing, but other sources can be used, such as statements in newspaper, standardised scales in psychology, or non-text samples such as a set of pictures. The collection of statements is called the Q-concourse, and a chosen portion of it is the Q-sample. The choice is usually based on a factorial design to ensure representativeness. The set of people is selected to represent different backgrounds in the population, not emphasising representativeness of a population. The number is commonly smaller than in survey applications.

Sorting refers to the placement of the Q-statements in a certain distribution, usually a quasi normal distribution (flatter than normal), from most unfavourable with a negative score to most favourable with a positive score. These scores are then correlated, and the correlations are factor analysed. A factor is a grouping of persons with similar views. The composite views, which are obtained through weighted averaging, become the major source for interpretation.

e) Q-Applications in Land Use Planning and Forestry

While this methodology initially was developed in the field of psychiatry, it has spread over many different other fields, including public policy (Brown 1997). More specifically, there have been a few application in land use planning and forestry. Three major such works are reviewed here.

The first one was by Coke and Brown (1976), which is very relevant to this case study and is referred to in Chapter V. It studied the opinions of people in the U.S. about the Federal Government's role in land use planning. Another study was by Steelman and Maguire (1999), in which Q methodology was used to study the opinions of people, also in the U.S., regarding various aspect of the management of national forests. A more recent study was carried out by Focht (2002), which used Q methodology to diagnose the land use conflicts among stakeholders. It found that the conflicts were not bipolar but orthogonal, which "open the way to potentially super-optimum solutions that can satisfy everyone" (p.1312).

In New Zealand Q methodology has been applied to analyse stakeholders' preferences for land use options in the Mackenzie/Waitaki Basin (Fairweather and Swaffield 1994). This study used visual images of six land uses on four land forms as the Q items, and identified several themes of preference for future land use options in the area. Some graphs were used to present new information to respondents and see if the additional information changed respondents' preference (Hock et al. 2001).

f) Q-Applications in this Study

Two types of Q applications were attempted in this study. One used verbal statements; the other graphical statements.

The verbal Q application drew the concourse from a mixture of stakeholder interviews and planning documents. The statements were normative, and their analysis was expected to generate normative information about the wishes and concerns of the existing types of stakeholders. Such information was expected to be useful for helping the stakeholders start their deliberation on the land use scenario that they want to develop. Armed with such information about the stakeholders, the facilitators of such deliberation would be able to choose the topics to start with, and which contentious issues are better left till later.

The second Q application used graphical samples. This is unconventional, additional to the range of non text Q samples that have been used, such as photographs (Fairweather 2000). The concourse was derived from that of the verbal Q application, but the statements were presented in graphs of land use changes and their different impacts. The graphs were the results of scenario modelling using FOLPI as described above. An analysis of stakeholder Q sorts was expected to generate positive information to be combined with the normative information. Stakeholder groupings would be known, with their preferred scenarios as well as the consensus and contentious scenarios between the groupings. This type of preference on land use scenarios is more positive, as it is presented in quantitative measures, e.g. how much change will happen in the scenario.

g) Use of Survey

The two poles in social science mentioned in the discussion on preference articulation approaches above can, in some circumstances, be complementary. As Lin (1998: 164) notes:

> When the case is one about which the researcher has intimate knowledge, such assumptions often are accurate, but when the researcher is an outsider – and, in the case of policy research, this often is the situation – the researcher's sense of the plausible can be tainted by prejudice, ignorance, or mistaken inferences.

Both approaches are mutually helpful. The information obtained from Q applications can be generalised through a positivist survey. As Lin (1998: 163) puts it, "Without positivist work, however, one does not know how widespread the existence of similar cases might be."

The benefit of the survey method was recognised but this study was not able to implement it. A survey following this study would use a smaller number of graphical cards, which, along with the absence of follow-up interviews, would run much more quickly and cover a wider stakeholder population.

2. Scenario Planning

The literature gives some compatible definitions of a scenario. Among others, Harries (2003) simply defines a scenario as "descriptions of alternative future realities". Ringland (1998) quotes Porter's definition of a scenario as "an internally consistent view

of what the future might turn out to be – not a forecast but one possible future outcome". Almost similarly, Chermack (2004) defines it as "alternative future environments". Godet (2001) defines a scenario as "coherent sets of hypotheses leading from a given original situation to a future situation. In line with these definitions, especially the last one, in this study a scenario is understood as "a description of how the situation will evolve from one reference time to another."

The scenario is one type in the four future research typologies developed by Becker and Dewulf (Dijk 2003). The other three are projections, predictions, and speculations. The four types differ in terms of causality and uncertainty. Projections are the extensions of current trends, and so they are highly certain but involve little causality analysis. Predictions build on projections, adding to them some information on the probable development in some future time. Speculations are the worst of all. They consider neither the current trends nor any information about causal relationships. Explorations, or scenarios, are not based on the current trends, but involve analyses of the causal relationship between phenomena.

Scenarios are important tools for any planning that involves large scale, long-term interactions between economic development and the environment (Prieler et al. 1998). They provide a coherent framework for analysis of the way various issues or sectoral developments impinge on one another and interact. Besides, they are a tool to encourage creativity, stimulate discussion, and place emphasis on specific points of interest. These two qualities make them necessary for combining various sectoral fields and models, and for opening up a constructive analysis of future problems. Dijk (2003) emphasises that "scenario generation and analysis are mainly practical processes that depend on creative participation and inputs from different sources as well as their knowledge and perspectives. This cannot be fully described and formalised in a rigid methodology.

Scenarios were already used in the multistakeholder exercise for developing the NFP. Therefore, they were also used in this study to allow evaluation of existing options of land use options. Their development is discussed in Chapter IV.

3. Case Study

As discussed in Chapter II, the need to renew and improve land use planning has elevated recently. This was both because of the changing condition of the forest lands,

and because of the adoption of the decentralised and participatory approach in many aspects of life in the country. It was realised that the study would find great difficulty in trying to develop the intended method at the national level. Hence the decision to develop a case study at the lower scale.

In order to apply the above methods, a study area needed to be determined. A case study at the district level was deemed appropriate. This is the lowest level in the government system where land-use planning takes place. Under the existing decentralization process districts were becoming very important in natural resource management. The smaller size is also desirable in terms of data and resource requirement in carrying out the case study. It allows collection of the necessary data, while still offering future application in other districts and at a higher geographic level.

a) Selection

Berau District in East Kalimantan was selected for several reasons. Firstly, forest land covers around 92 percent of the District's land (Berau District Centre for Statistics Services 2001) and such dominance in the overall land use is a good basis for developing a methodology towards informed forest-based land-use planning. Secondly, there was much relevant data available in the district, owing especially to the existence of the Berau Forest Management Project (BFMP). As Tyrie (1999: 1) put it: "An unparalleled data set of environmental, inventory and regrowth information has been built up for Labanan concession." In fact the data available goes beyond the Labanan concession and beyond the forestry sector. This data availability is important for the purpose of developing the land-use planning methodology, though the methodology itself would have to consider that its applicability should accommodate average availability of data across the country. Thirdly, in 2000 Berau was in the process of developing its land-use planning. This allows the study to include a real land use planning scenario.

b) Geographic and Economic Situation

Berau District is one of the eight districts in East Kalimantan, and is located in the northeastern part of Kalimantan Island with Tanjung Redep as the capital (Figure III.1). Its area is around 34,100 km^2, of which 28.7 percent is sea area, leaving a land area of around 24,200 km^2 with a population of only about 120,000 people. The district

is relatively isolated, accessible from the provincial capital Samarinda by air in an hour, by road in 13 hours, or by sea in 17 hours.

The economy and welfare in the district are best understood through a comparison of pre crisis and post crisis situations. Average per capita GDP in 2001 was Rp 5,732,825 or USD 637. In the Indonesian currency this GDP level was an increase from Rp 4,445,506 in 1997, but a decline in US$ from US$ 2,390 in 1997. In 1997 Berau District's GDP was almost double the national level, but slightly below that of East Kalimantan Province[4]. However, the relatively high economic performance was accompanied by the finding that "welfare indicators suggest that the wealth of the regency has not benefited the local population to the extent elsewhere in East Kalimantan" [5]. The welfare indicators included ratios of motorcycle registration, electricity connection, piped water access, and hospital beds.

c) Land-use Planning

As is common in the country, land-use planning of Berau District Government has been based on Consensus Land-Use Planning, which is the forestland allocation agreed upon by a number of government agencies in the early 1980s. It was established in response to the booming forest utilisation, and is known to be mostly deskwork and lacks reality checks. This planning system is referred to in the Berau Regency in Figure 2000 (Berau District Centre for Statistics Services 2000), which is presented in Figure III.2.

In 2001, however, a more reliable basis was available and recognized by the District Government. An important input was BFMP's digital maps, which was the result of extensive field activities. The District government in its Land-Use Planning 2001-2011, which will be referred to below, has used the data.

E. Conclusion

The study's aim, research questions and methods are closely related. The aim will be attained if the research questions are answered, for which appropriate methods

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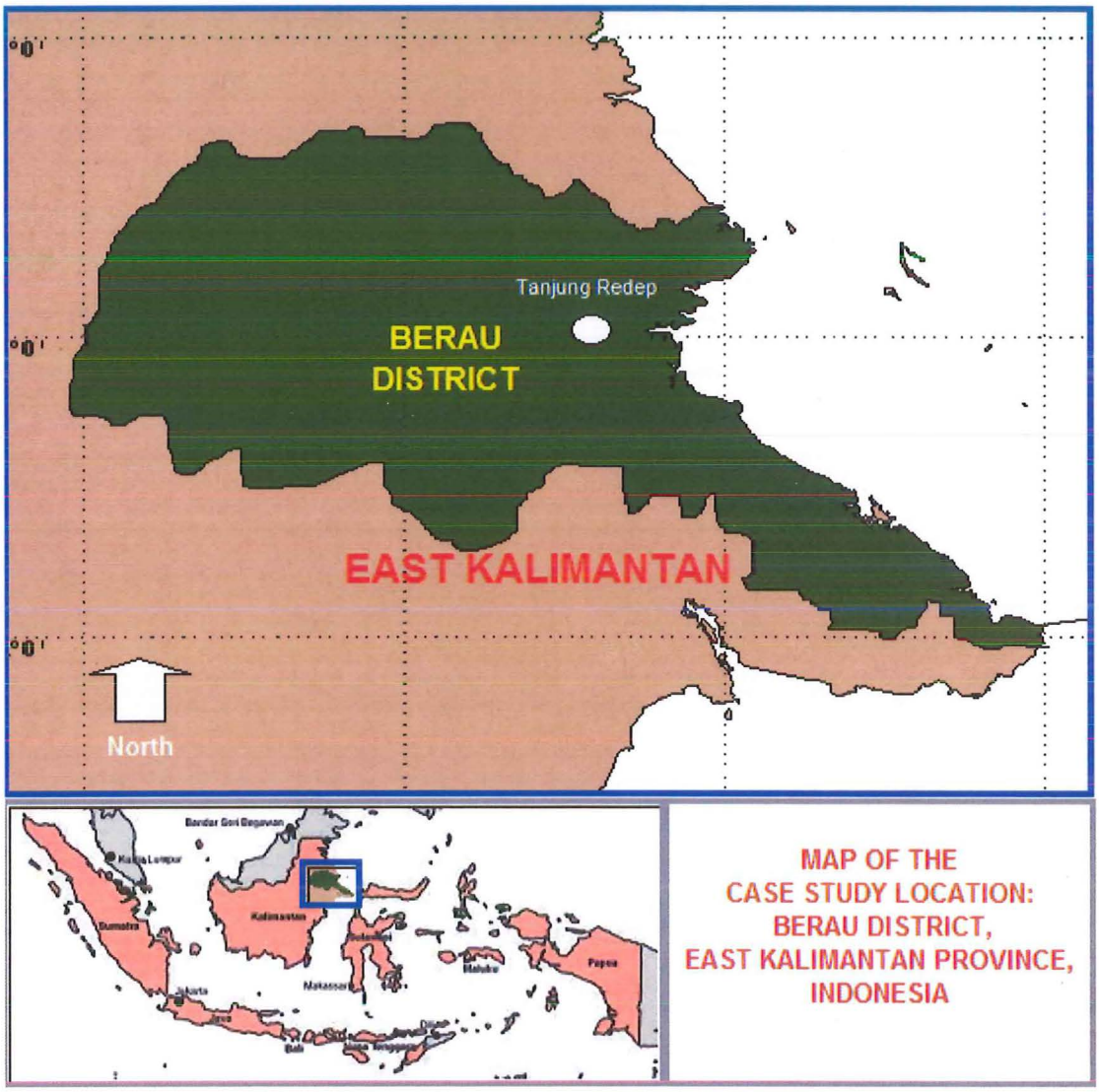
[4] http://www.bfmp.or.id/Berau/berau-3.htm. Berau Forest Management Project Management. Berau Regency – The Economy. In Regional District – Berau District. Visited 11 April 2003.
[5] Ibid.

are needed. In order to develop the right land use planning scenario, the options should be explored, their consequences should be evaluated, and in these processes stakeholders' preferences should be understood and considered. To do this, the study



Source: Own production using DMAUSE 2.0 from the U.S. Defense Mapping Agency

Figure III.1: Map of Berau District and Its Location in Indonesia

used a case study approach, in which the scenario concept was used to explore land use planning options. FOLPI modelling environment was used to simulate the scenarios and their different consequences. Q-Methodology was chosen for studying people's preferences on the matter. The methods were briefly described, before their specific application in this study presented.

The following three chapters present major undertakings in the Case Study. First is the scenario modelling using FOLPI, followed by the two chapters on investigation of stakeholders' preferences in land use planning. One investigation used a qualitative

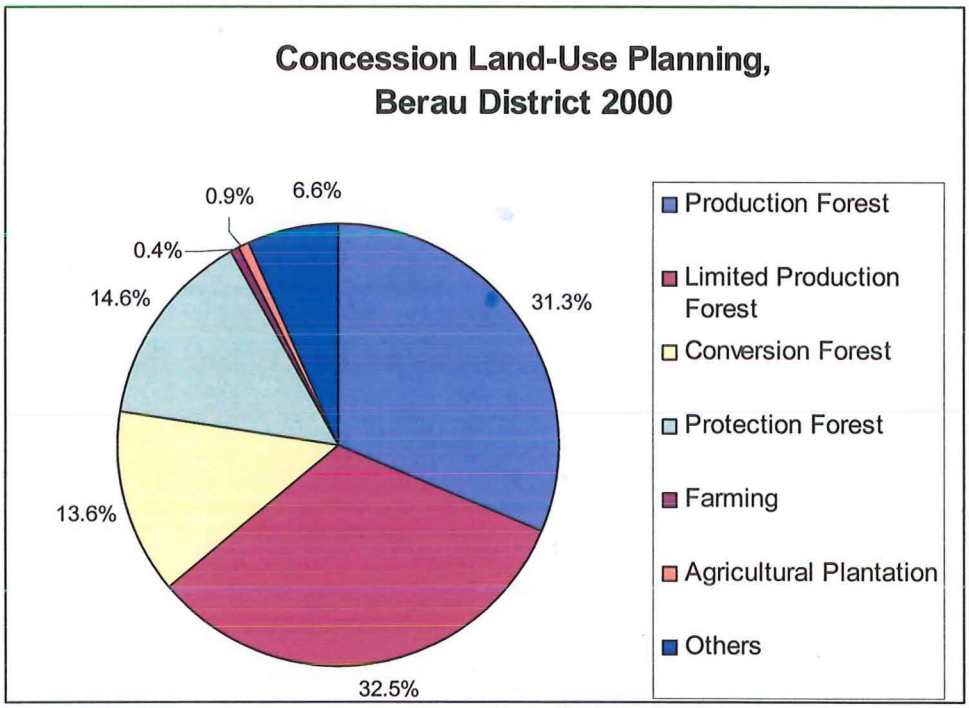


Figure III.2: Consensus Land Use Planning of Berau District in 2000

approach, while the other used a quantitative approach. A chapter comparing the two then follows.

CHAPTER IV
SCENARIO MODELLING

A. Introduction

This chapter aims to tackle the first question of the study as identified in Chapter III on methodology, i.e. how to quantitatively present land use plans and their consequences. Such quantitative presentations of land use plans are necessary for exploring land use planning options before selecting the preferred one.

As established in Chapters I and III, scenarios are deemed suitable for selecting a land use plan. Also established was that the FOLPI modelling environment be chosen for modelling the scenarios and their consequences. This chapter presents the way land use planning scenarios were developed, and how FOLPI was applied for modelling the scenarios for Berau District as the case study area. This section will describe the method of carrying them out and will be followed by the results.

B. Method

1. Land Use Planning Issues

Interviews were used to learn what land use planning issues the stakeholders deemed important. The information sought included the kinds of land use changes the subjects would like to happen or not, and the kinds of impacts with which they are concerned.

2. Scenario Development

Scenarios were developed with a view to cover as wide a range of options as possible. The range of options is related to the issues considered important by the stakeholders. This is related to the need for the Q-Methodology to secure representativeness of the Q-sample, which will be reported in the next chapter.

3. Data for Scenario Modelling

A range of data was required for modelling the scenarios in FOLPI. Essentially they comprised the croptypes, their area, and the related resources.

a) Croptypes and their areas

First of all, the range of croptypes under study needed to be identified. In the original forestry application of FOLPI, a croptype is an aggregation of stands which may differ in age but are regarded as uniform in terms of future management and yield production (Manley and Threadgill 1991; Forest Research Institute 1993). A land use such as *Acacia mangium* forest plantation can be multiple croptypes if the stands differ in the management and yield. For each croptype, the area at the starting period needed to be known.

b) Resources involved in the management of each croptype

The management of a croptype may involve a range of resources, such as financial resources and yield. Other resources to be included in this application were those that represent impacts of land use planning, such as the biodiversity index, carbon stock, etc. The range of relevant resources to be included needed to be identified for their data collection.

The resources had to be presented on a per unit area basis, which was per hectare in this study. The changes over time also had to be provided. For example, the yield of *Acacia mangium* needed to be presented (m^3/ha) for each age. As the plantation grows the yield should increase, and such a yield table has to be developed for each croptype.

C. Land Use Planning Issues

Land use planning issues in Berau District were learned through a series of interviews. During the period November 2001 – May 2002 the interviews were carried out with 49 people. They represented geographical levels of district, provincial, and central, and embraced different institutions including government, private sector, NGOs and universities.

A broad range of land use planning issues appeared during the interviews. Stakeholders are generally concerned about three aspects of natural resources

management, i.e. economic, social and ecological aspects. The economic concerns are centred on the need to use different natural resources for continually raising revenues. The recent start of the decentralisation process has shifted greater authority in natural resource management to the district government, hence increasing its interest in the economic benefits. Natural resource management that would contribute more revenue to the district government may now be more appealing for the district land use planner than ever before.

The social concerns raise the need to manage the distribution of revenues incurred from natural resource management. While this is clearly the aspiration of the common people, it is also the Government's interest that people get a share of the financial gain from natural resource management, mainly through job opportunities.

The ecological concerns are related to the need to control natural resource management to minimise the negative ecological impacts. For example, already there have been concerns among some people in the district about the flooding risk from careless use of natural resources in the district. Biodiversity is another example of concern, with efforts already initiated to save orang-utan amid their habitat fragmentation because of forest clearing.

The various concerns of the stakeholders could be summarized as an interest in understanding natural resources' total economic value (TEV), i.e. the combination of economic, ecology and social values.

D. Scenario Identification

The input from the interviews became the basis for developing a factorial design for land use planning scenarios. The design took into account stakeholders' concerns about the economic, ecological, and social aspects of land use planning. In order to learn how much emphasis they give to each aspect, scenarios with different emphases were developed according to the factorial design in Table IV.1 below.

The design contains six scenarios, each with different emphasis on the three aspects of sustainable development. Each scenario has an aspect with a strong emphasis, another with a medium emphasis, and the last one with little emphasis. For example, row 1 of Table IV.1 contains scenarios that are economically sound. The column indicates the aspect of medium emphasis. Column 1 row 1 (in grey colour) is not a potential scenario because it is not medium either socially nor ecologically. Rather, it is

poor in these two aspects, and so, just like the other two cells in grey colour, it is inferior to the ones in black that all have one sound aspect, one medium aspect, and just one poor aspect.

Table IV.1 Factorial design of land use planning scenarios for Berau District

Medium: / Sound:	Economic	Social	Ecological
Economic	Economically sound Socially poor Ecologically poor	c. Economically sound Socially medium Ecologically poor	d. Economically sound Socially poor Ecologically medium
Social	e. Economically medium Socially sound Ecologically poor	Economically poor Socially sound Ecologically poor	f. Economically poor Socially sound Ecologically medium
Ecological	g. Economically medium Socially poor Ecologically sound	h. Economically poor Socially medium Ecologically sound	Economically poor Socially poor Ecologically sound

Apart from these six scenarios, there are two others. One is Berau District's ten-year plan from 2001. The plan used in this study was still in draft version as of May 2002, but a final and formal version was issued in early 2004. The plan was originally prepared by the District's Planning Board, with assistance from the Jakarta based Agency for Technology Review and Application. The BFMP and its former staff provided technical mapping information.

The other scenario is the Business As Usual, which reflects current practice as of 2001. The data for this scenario was from the BFMP's land use maps for the years of 1997 and 2000 (Steenis 2001). It is assumed that the three-year trend extended throughout the planning period.

E. Data for Scenario Modelling

Among the main reasons for choosing Berau District as the Case Study site was the availability of data developed by the BFMP. The project's data were available in the forms of digital maps, spreadsheet models, and technical documents and papers.

Another major source of data for scenario modelling was Berau District's planning and statistics documents. The data are presented below.

1. Croptypes and their areas

In order to identify the croptypes, first of all the range of land uses subjected to changes needed to be identified. This was done by examining district statistics, stakeholders' opinions, and the BFMP's report titled Detailed Land Use Changes in the Berau District, 1997-2000 (Steenis 2001). Seven land uses were identified, i.e. natural conservation forest, natural production forest, plantation forest, oilpalm plantation, shifting cultivation, coal mining, and grassland.

A land use may vary in terms of future management and yield. Consequently, it may have several croptypes. The natural production forest, for example, consisted of virgin production forest, logged-over forest, and secondary forest. Similarly, the plantation forest included rotations 0 to 5, each of which became a croptype, because its growth rate increased from rotation to the next owing to tree improvement. The development of several croptypes for different productivity rates can be applied for other land uses, such as the oilpalm plantation. In order to achieve sustainability, increased productivity is apparently preferred to area expansion.

The above mentioned BFMP's report (Steenis 2001) also provided most of the data on the area of each croptype. Other data were obtained from the institutions managing the croptypes. These included the forest plantation company and coal mining in the district. The BFMP report classifies lands in the districts into 45 uses. These were reclassified into the seven land-uses with their sub-land uses here so-called croptypes. The set of croptypes and their areas as of year 2001 are presented in Table IV.2.

The sixteen croptypes were presented by age, i.e. how much was of age 1, 2, 3, etc. in year 2001. Such data would allow simulation of land use changes over a fifty-year planning period. The simulation would become more meaningful when data is also provided on the resources involved in the land use changes.

2. Resources related to croptype development

FOLPI can take data on any resources related to the development of a croptype. The resources do not need to be input or output to the management of the croptype. The

model would include them in the land use change simulation, and report back on the changes that take place in resources during the period of changes.

Table IV.2: Croptypes and the Area, Berau District in 2001

Land Use	Croptype	Description	Area (ha)
Conservation forest	VIRGINCON	Virgin forest allocated for conservation	353,776
Production forest	VIRGINMNG	Virgin forest allocated for production	145,000
	LOGFOR	Logged over forest	888,330
	SECFOR	Secondary forest	328,615
Forest plantation	ACAMA0	*Acacia mangium* plantation on former grasslands	0
	ACAMA1	First rotation of *Acacia mangium* plantation on formerly forestland	67,320
	ACAMA2	Second rotation of *Acacia mangium* plantation on former forestland	6,056
	ACAMA3	Third rotation of *Acacia mangium* plantation on former forestland	0
	ACAMA4	Fourth rotation of *Acacia mangium* plantation on former forestland	0
	ACAMA5	Fifth and later rotation of *Acacia mangium* plantation on former forestland	0
Oilpalm plantation	OILPALM0	Oilpalm plantation on former grassland	0
	OILPALM	Oilpalm plantation on former forested land or replanted from itself	1,032
Coal mining	COAL	Coal mining	1,342
Shifting cultivation	SHIFT	Long-fallowed shifting cultivation	6,407
	SFSHIFT	Short-fallowed shifting cultivation	4,140
Grassland	GRASS	Grassland	85,000
	TOTAL		1,823,721

For the purpose of evaluating land use scenario consequences, certain resources were chosen to represent the economic, ecological[6] and social aspects. Apart from these impact-indicator resources, also included were croptypes' products, such as wood yield (timber and pulplog), oilpalm, coal, and shifting cultivation revenue. They were useful for calculating the impacts.

The resources were presented in yield tables. For example, a croptype needs data on how much timber yield per hectare it has in year 1, how much it becomes in year 2, and so on. Similarly, for each croptype, data were required on how much labour was required in each year. For clarity, this data structure is presented in Table IV.3.

Table IV.3: Resources data required for modelling land use scenarios

Category		Year							
Aspect	Item (unit)	1	2	3	4	.	.	.	50
Yield	Total wood yield (m3)								
	Timber yield (m3)								
	Pulplog yield (m3)								
	Oilpalm yield (ton)								
	Shifting cultivation revenue (US$)								
Econo-mic	Operational cost (US$)								
	Harvest cost (US$)								
	Harvest revenue (US$)								
Ecolo-gical	Biodiversity index (unit)								
	Soil cost (US$)								
	Carbon stock (TonC)								
Soci-al	Operation labour (manday)								
	Harvest labour (manday)								

Data of the categories in Table IV.3 were to be provided for each croptype. Data were collected from different sources, of which BFMP was a major one. Quite detailed data obtained from BFMP included land maps and the management of natural forest, forest plantation, and oilpalm. The maps were in the ArcView format, the management

[6] Following Kosonen, M., A.Otsamo and J. Kuusipalo (1997), it consists of biological index, soil cost, and carbon stock. In this study, the biological index was developed for the site on an assumption that it is reflected by the abundance of bird and tree species. Soil cost trends were developed for the site based of data a widely referred study in the Philippines. Carbon stock was estimated based on a study in Sumatra.

information was in spreadsheet models. For shifting cultivation, rougher data from literature were used, while for coal mining the main data was obtained from the only coal company in the district. Ecological data were gotten from estimates by a study in a neighbouring district (Kosonen et al. 1997), which was deemed better estimates for the study site in Berau than more detailed estimates for other areas in Indonesia, such as those carried out for the Leuser National Park in Sumatra (Beukering et al. 2001; Beukering et al. 2003). In the absence of ecological impact data for coal mining, the opening of vegetated lands for coal mining was treated as a mere clearing of the vegetation, without accounting for the likely much worse impacts. More detail information on the data sources is presented in Annex 1. Zero was entered when the category was not applicable to the croptype. As these data along with area data were provided, FOLPI could now perform the scenario simulation.

F. Scenario Development

With a view to modelling the six scenarios in Table IV.1 above, the first attempts were to model the Business As Usual scenario and the District Government scenario. The results were subsequently evaluated to see how they fitted in Table IV.1.

The technical procedure of FOLPI application is not presented in this chapter. Rather, a technical note on the application is provided in Annex 1.

1. Business As Usual Scenario

The ongoing land-use scenario in Berau District was inferred from a study in 2000 by Steenis (2001). He concluded that forest cover in Berau District had decreased by 128,000 ha or six percent between 1997 and 2000. This conclusion was based on interpretation of Landsat imageries acquired in 1997 and in 2000. The Business as Usual (BAU) scenario was built on the trend over the three years. The 45 land uses were regrouped, as described in the section on croptyping above. A comparison of the two years is presented in Table IV.4. The table indicates how much a croptype changed during the three-year lapse.

Table IV.4: Land use areas in Berau District in 1997 and 2000 (figures in hectares)

No	LAND USE	1997	2000	Change/year
1	Virgin forest	524,510	500,699	-7,900
2	Logged over forest	1,050,272	899,235	-53,991
3	Secondary forest	272,550	336,202	+21,217
4	Forest plantation	27,050	74,018	+15,650
5	Oilpalm plantation	0	1,029	+350
6	Grassland	14,013	35,731	+7240
7	Bareland'	112	6,246	+2,044
8	Coal mining	358	1,686	+443
9	Shifting cultivation	3,977	5,175	+400
10	Total	1,894,839	1,826,290	

The changes in the last column of Table IV.4 were implemented in a FOLPI model. As later compared with the other scenarios, this one was evaluated as "economically medium, socially poor, ecologically poor". The indicators and key land use changes are summarised in Table IV.5.

2. District Government Scenario

Berau District Government had produced a Draft Land-Use Planning 2001-2011 (Berau, District Government 2001) with the help of a Jakarta based consultant team from BPPT (Agency for the Assessment and Application of Technology). A digitised map of the target land use structure accompanied the plan. Cross tabulation of the map against the land-use map 2000 resulted in land-use change tracks (Table IV.6). For example, it shows a great ambition of the District Government for the development of oilpalm plantations. Nearly 20,000 ha/year of new oilpalm plantations were to be established during the first ten years. They were from formerly virgin forest (585 ha/year), logged over forest (14,000 ha/year), secondary forest (2,984 ha/year), and grassland (1,848 ha/year). Also notable was the intention to favour conservation, with protection forest projected to double from the existing allocation as presented in Figure III.2.

The land use changes were translated into commands in FOLPI to build a District Plan model. Considering its ideal nature as a plan, the scenario was evaluated as "economically sound, ecologically medium, socially medium" and was made a bench-

Table IV.5: Characteristics, Indicators, and Key Land Use Changes of the Business As Usual Scenario

Characteristics	Indicator	Key Land Use Changes
Economically medium	▫ Gross revenue maximum 400 million US$ ▫ Forestry tax maximum range 60-35-45 million US$ ▫ Coal tax maximum US$ 13 million	▫ Conservation virgin forest: all logged after the production virgin forest finished ▫ Production virgin forest: all logged in 18 years ▫ LOA: 125,120 ha cleared for forest plantations; 17,500 ha for oilpalm; over 1 million ha becomes secondary forests ▫ Secondary forest: 20,000 ha cleared for short-fallowed shifting cultivation; 1 million ha becomes grassland ▫ Forest plantations: 120,000 ha new ▫ Oilpalm plantations: 17,500 ha new ▫ Shifting cultivation: long-fallowed stable at 8,000 ha, short-fallowed 20,000 ha new, then ceases when productivity lost ▫ Grassland: 20,000 ha/yr new ▫ All coal reserves to be mined
Socially poor	▫ Labour requirement trend around 7 million workdays ▫ Shifting cultivation: long fallowed stable at 8,000 ha, short-fallowed increase to 90,000 ha, then ceases	
Ecologically poor	▫ Bio-index drops to below 200 thousand units ▫ Soil cost keeps increasing up to 3,500 thousand US$ ▫ Carbon stock keep decreasing to 150 million TonC	

Table IV.6: Land Use Change Track of Berau District From Year 2000 Land Uses to District Plan 2011 Land Uses (all figures in hectares)

Land Use District Plan:	Convertible Forest	Protection Forest	Production Forest	Limited Production Forest	Agricultural Plantation	Dryland Farming	Grand Total
Land Use 2000:							
Virgin Forest	1,902	418,590	4,482	95,360	4,396	9,622	540,840
Logged Over Forest	63,240	147,197	103,908	447,713	82,836	86,298	942,948
Secondary Forest	7,646	28,314	100,297	136,014	18,707	1,928	322,289
Forest Plantation	51,565	0	5,597	12,522	4,058	9,215	83,447
Oilpalm	0	0	0	0	0	1,043	1,043
Grass	10,085	1,462	8,090	2,273	3,942	704	35,257
Bareland	1,880	55	1,269	860	232	301	6,629
Coal	0	0	0	0	1,540	0	1,676
Shifting Cultivation	0	0	1,883	203	44	49	5,188

mark to evaluate the other scenarios. The scenario's characteristics, indicators, and key land use changes are presented in Table IV.7.

Table IV.7: Characteristics, Indicators, And Key Land Use Changes of the District Plan Scenario

Characteristics	Indicator	Key land use changes
Economically sound	° Gross revenue maximum 1,175 million US$ ° Forestry tax maximum range 60-30-50 million US$ ° Coal tax maximum 50 million US$	° Conservation virgin forest: intact ° Production virgin forest: 92,800 ha properly logged; 5,850 ha cleared for oilpalm, 8,940 ha for short-fallowed shifting cultivation ° LOA: 125,120 ha cleared for forest plantations; 140,000 ha for oilpalm; 82,650 for short-fallowed shifting cultivation ° Secondary forest: 29,340 ha cleared for oilpalm; 4,000 ha/year properly logged ° Forest plantations: 125,120 ha new ° Oilpalm plantations: 193,670 ha new ° Shifting cultivation: long-fallowed stable at 8,000 ha; short-fallowed 91,590 ha new, then ceases when productivity lost ° All coal reserves to be mined
Socially medium	° Labour requirement trend 37-22-30 million workdays ° Shifting cultivation: long fallowed stable at 8,000 ha, short-fallowed increase to 90,000 ha, then ceases	
Ecologically medium	° Bio-index drops then stable at 450 thousand units ° Soil cost fluctuates around 3,000 and 2,500 thousand US$ ° Carbon stock drops to just below 325 million TonC.	

3. The Six Factorial Design Scenarios

The first two scenarios give a basis for developing the six scenarios identified through the factorial design in Table IV.1 above. For modelling the scenarios in FOLPI, a set of assumptions was developed as general guidelines to link land use changes and the impacts, be they economic, ecological or social.

For instance, the data obtained indicated that oilpalm and forest plantations involved high revenue per hectare. This implied that such land uses should be favoured in developing economically sound scenarios. Coal actually also gives high revenue per hectare and so its level of exploitation affects the economic performance of the scenarios. The production level variation, however, is more a subject of environment politics than that of land use planning. Coal production is, therefore, used as an indicator of ecological friendliness. Another feature of ecological friendliness is a lower level of virgin forest conversion, implying that economic production is carried out on

ecologically less valuable land uses such as grassland, secondary forest or logged over forests. On the social aspect, an indicator of friendliness is the amount of labour required. In this regard oilpalm plantation is more favoured than forest plantation because the former requires more labour per hectare in its management. The other indicator assumed for social friendliness is the amount of shifting cultivation involved in the scenario, because this type of land use cares for poorer people. There is, however, some ecological aspect in this regard because there is shifting cultivation that is long-fallowed and sustainable and one that is short-fallowed and unsustainable. The set of assumptions as general guidelines appears in Table IV.8.

The general guidelines were then interpreted for each scenario. For instance, Scenario 1 is economically sound, socially medium, and ecologically poor, which implies unsustainable land use changes. These include extensive disturbance of ecologically valuable forests (virgin forests, logged over forests) to be replanted into plantations (oilpalm and forest plantations) and shifting cultivation. Ecologically less valuable secondary forest, is converted into least ecologically valuable land use, the grassland. Ecological poorness is also reflected by exploitation of coal reserve to the full extent.

Table IV.8: General Guidelines for Modelling Land Use Planning Scenarios of the Case Study

	SOUND	MEDIUM	POOR
Economic	° High rate of oilpalm and forest plantations	Moderate	° Low rate of oilpalm and forest plantations
Social	° High rate of shifting cultivation, more oilpalm (labour intensive) than forest plantation	Moderate	° Low rate of shifting cultivation ° More forest plantations (less labour intensive) than oilpalm plantation
Ecological	° Economic replanting is from less vegetated lands (grassland, secondary and logged-over forests) ° Shifting cultivation is long-fallowed ° Not all coal reserves in the forest mined.	Moderate	° High rate of virgin forest conversion ° Shifting cultivation is short-fallowed

The principal land use changes were then given magnitudes in hectares and entered as FOLPI commands or constraints. The FOLPI models were run and the results evaluated to see if they had represented the scenarios according to their respective

characteristics. Modifications of the models were made when necessary. The final models for the six factorial design's six scenarios were as described below. Only the main features of the scenario are described, the rest being systematically contained in the tables.

d) Scenario 1: "Economically sound, socially medium, ecologically poor"

The characteristics of this scenario were deemed to be close to the District Plan scenario, which was regarded as "Economically sound, socially medium, ecologically medium." The difference is that this scenario was ecologically poor. The District Plan model was accordingly modified. Some disturbance to the conservation virgin forest was introduced, and so was short-fallowed shifting cultivation. The representation of the model's characteristics is as in Table IV.9.

Table IV.9: Modelling of Scenario 1

Characteristics	Indicator	Key Land Use Changes
Economically sound	° Gross revenue maximum 1,150 million US$ ° Forestry tax maximum range 60-70 million US$ ° Coal tax maximum 50 million US$	° Conservation virgin forest: 30,000 ha cleared for short-fallowed shifting cultivation; 260,000 ha selectively logged ° Production virgin forest: 30,000 ha cleared for oilpalm plantation; 100,000 selectively logged ° LOA: 192,000 ha cleared for forest plantation, 70,000 ha for oilpalm, 20,000 for short-fallowed shifting cultivation; 100,000 improperly logged and becomes secondary forest, 20,000 ha/year properly logged ° Secondary forests: 100,000 ha new from LOA ° Forest plantations: 192,000 ha new ° Oilpalm plantations: 130,000 ha new ° Short-fallowed shifting cultivation: 50,000 ha new ° All coal reserves to be mined
Socially medium	° Labour requirement trend 27-22-25 million workdays ° Shifting cultivation: long fallowed stable at 8,000 ha, short-fallowed increase to 12,000 ha.	
Ecologically poor	° Bio-index drops to below 400 thousand units during 11 first years ° Soil cost increases to around 3,000 thousand US$ ° Carbon stock drops to just below 250 million TonC.	

e) Scenario 2: "Economically sound, socially poor, ecologically medium"

In the economic aspect, this scenario was similar to scenario 1. Being socially poor, its labour requirement was lower than that of scenario 1. Shifting cultivation was also less extensive in this scenario. On the contrary, it is more ecologically friendly as compared to scenario 1, which was indicated by fewer disturbances to conservation

virgin forests. These resulted in a higher biodiversity index and carbon stock, and lower soil cost. The representation of the model's characteristics is as in Table IV.10.

Table IV.10: Modelling of Scenario 2

Characteristics	Indicator	Key Land Use Changes
Economically sound	° Gross revenue maximum 1,100 million US$ ° Forestry tax maximum range 65-60 million US$ ° Coal tax maximum 50 million US$	° Conservation virgin forest: 175,000 ha selectively logged ° Production virgin forest: 48,000 ha cleared for forest plantation and 30,000 ha for oilpalm ° LOA: 64,000 ha cleared for forest plantation, and 50,000 ha for oilpalm; 125,000 ha improperly logged and becomes secondary forests ° Secondary forest: 64,000 ha cleared for forest plantation and 50,000 ha for oilpalm plantation ° Forest plantations: 176,000 ha new ° Oilpalm plantations: 130,000 ha new ° Short-fallowed shifting cultivation: the existing becomes secondary forest when losing productivity ° All coal reserves to be mined
Socially poor	° Labour requirement trend 20-17-20 million workdays ° Shifting cultivation: long fallowed stable at 8,000 ha, short-fallowed ceases after the existing loses productivity.	
Ecologically medium	° Bio-index drops to below 430 thousand units gradually ° Soil cost increases to around 2,700 thousand US$ ° Carbon stock drops to 280 million TonC.	

f) Scenario 3: "Economically medium, socially sound, ecologically poor"

Being favourable towards the social aspect, this scenario involved much shifting cultivation. And being ecologically poor, the shifting cultivation was short-fallowed. Much natural forest was cleared or degraded. The representation of the model's characteristics is as in Table IV.11.

g) Scenario 4: "Economically poor, socially sound, ecologically medium"

Like scenario 3, this scenario is socially sound, and therefore, it involves much shifting cultivation. As it is ecologically medium rather than poor, however, the shifting cultivation was more long-fallowed, and only a little was short-fallowed. Forest clearing and degradation were also less than that in Scenario 3. The representation of the model's characteristics is as in Table IV.12.

Table IV.11: Modelling of Scenario 3

Characteristics	Indicator	Key Land Use Changes
Economically medium	° Gross revenue maximum 1,000 million US$ ° Forestry tax maximum range 60-30-50 million US$ ° Coal tax maximum 50 million US$	° Conservation virgin forest: 150,000 ha logged; 40,000 ha cleared for forest plantation, 50,000 for oilpalm, 100,000 for short fallow shifting cultivation ° Production virgin forest: 140,000 ha selectively logged ° LOA: 15,000 ha/year selectively logged, 200,000 ha improperly logged and becomes secondary forests; 40,000 ha cleared for forest plantation, 50,000 ha for oilpalm, 100,000 ha for short-fallowed shifting cultivation ° Secondary forest: 100,000 ha cleared for short-fallowed shifting cultivation and 5,000 ha/year properly logged ° Forest plantations: 80,000 ha new ° Oilpalm plantations: 100,000 ha new ° Short-fallowed shifting cultivation: 300,000 ha (6,000/year) new ° All coal reserves to be mined
Socially sound	° Labour requirement trend 25-20-25 million workdays ° Shifting cultivation: long fallowed stable at 8,000 ha, short-fallowed increase and stabilize at 80,000 ha	
Ecologically poor	° Bio-index drops to 375 thousand ° Soil cost increases to around 3,000 thousand US$ ° Carbon stock drops to just below 250 million TonC.	

h) Scenario 5: "Economically medium, socially poor, ecologically sound"

Being ecologically friendly, this scenario involved little forest clearing or degradation. Only production natural forest is selectively logged. As it is socially poor, little shifting cultivation was involved. Coal mining was reduced to minimise negative ecological impacts. The representation of the model's characteristics is as in Table IV.13.

i) Scenario 6: "Economically poor, socially medium, ecologically sound"

As in Scenario 5 which is also ecologically friendly, forest disturbance was restricted to the legal limit. Coal mining was restricted to minimise forest degradation, with the consequence that it is economically poor. There was some shifting cultivation but the long-fallowed one. The representation of the model's characteristics is as in Table IV.14.

Table IV.12: Modelling of Scenario 4

Characteristics	Indicator	Key Land Use Changes
Economically poor	° Gross revenue maximum 800 million US$ ° Forestry tax maximum range 40-30-35 million US$ ° Coal tax maximum 42 million US$	° Conservation virgin forest: 105,000 ha logged ° Production virgin forest: all properly logged ° LOA: 10,000 ha/year properly logged, 125,000 ha improperly logged and becomes secondary forests; 24,000 ha cleared for forest plantation, 40,000 ha for oilpalm, ° Secondary forest: 32,000 ha cleared for forest plantations, 40,000 ha for oilpalm, 100,000 ha for shifting cultivation; 5,000 ha/year properly logged ° Forest plantations: 56,000 ha new ° Oilpalm plantations: 80,000 ha new ° Both long & short-fallowed shifting cultivation: each 50,000 ha (1,000/year) new ° Only 75% coal reserves to be mined
Socially sound	° Labour requirement trend 15-12-13 million workdays ° Shifting cultivation: the long-fallowed increases up to 50,000 ha, short-fallowed increase and stabilize at 15,000 ha-	
Ecologically medium	° Bio-index drops to 515 thousand units during 20 first years ° Soil cost increases to around 2,000 thousand US$ ° Carbon stock drops to just 330 million TonC.	

Table IV.13: Modelling of Scenario 5

Characteristics	Indicator	Key Land Use Changes
Economically medium	° Gross revenue maximum 800 million US$ ° Forestry tax maximum range US$40-45-55 million ° Coal tax maximum US$ 42 million	° Conservation virgin forest: intact ° Production virgin forest: all properly logged ° LOA: 29,300 ha/year properly logged ° Secondary forest: 80,000 ha cleared for forest plantations, 15,000 ha for oilpalm, 100,000 ha for long-fallowed shifting cultivation ° Forest plantations: 120,000 ha new ° Oilpalm plantations: 25,000 ha new ° Long-fallowed shifting cultivation stable at 8,000 ha, short-fallowed shifting cultivation ceases ° Only 75% coal reserves to be mined
Socially poor	° Labour requirement trend 7 million workdays ° Shifting cultivation: long fallowed stable at 8,000 ha, short-fallowed ceases when productivity lost	
Ecologically sound	° Bio-index drops to 520 thousand, then increases ° Soil cost increases to around 2,000 thousand US$ ° Carbon stock stable around 350 tonC	

Table IV.14: Modelling of Scenario 6

Characteristics	Indicator	Key Land Use Changes
Economically poor	° Gross revenue maximum 775 million US$ ° Forestry tax peak range -45 million US$40 ° Coal tax maximum 37 million US$	° Conservation virgin forest: intact ° Production virgin forest: all properly logged ° LOA: 29,300 ha/year properly logged ° Secondary forest: 56,000 ha cleared for forest plantations, 45,000 ha for oilpalm, 70,000 ha for long-fallowed shifting cultivation ° Forest plantations: 70,000 ha new ° Oilpalm plantations: 65,000 ha new ° Long-fallowed shifting cultivation 8,000 ha new, short-fallowed shifting cultivation ceases ° Only 50% coal reserves to be mined
Socially medium	° Labour requirement trend 12-9-11 million workdays ° Shifting cultivation: long fallowed increases and stable at 80,000 ha, short-fallowed ceases when productivity lost	
Ecologically sound	° Bio-index drops to 520 thousand, then increases ° Soil cost increases to around 2,000 thousand US$ ° Carbon stock stable around 350 tonC	

G. Model Run Results

Model run results were indeed already used in the iterative process of scenario modelling above. This section describes the uses of the results beyond that exercise. First the types of data provided by the model runs are presented, followed by their presentations with some examples.

1. Types of Data

FOLPI produces summary reports, which contain the dynamics during the modelling period, which is fifty years in this study. The information provided can be classified according to the timing of their occurrence, i.e. intermediate, final, and residual. *Intermediate* items occur repeatedly along the modelling period. For example, the oilpalm harvest is treated as an intermediate item because it is considered as the thinning products of the plantations. The final product would occur when the plantation is cleared at the end of its rotation. *Final* items occur when harvesting takes place. *Residual* items remain after harvesting. Some items appear both as final and residual, because some of the items remain after some are harvested. An example is timber yield, some of which remains after part of the forest area is harvested. With biodiversity, as another example, the bioindex units removed during harvesting appear as 'final', while

those still attached to areas left appear as 'residual'. Such classifications are presented in Table IV.15.

Summaries containing these types of data can be retrieved for all croptypes, any combination of croptypes, or any individual croptype. This depends on the kind of information to be presented based on the data.

2. Information Presentation

The summary results became the data source for graphic presentations. For each scenario, each data item in Table IV.15 above can be presented for each land use, or any combination of land uses. There are many options for presenting these data. Two of such options are described below.

a) Feature of a scenario and its component land uses

One option is to present a graph of a feature of a district scenario, accompanied by the contribution of each component land use. For example, a graph of the scenario's total biodiversity index dynamics during the modelling period can be presented along with such graphs of each land use or each croptype. These series of biodiversity graphs appear in Figure IV.1. The bigger graph on the top is the District's total Bioindex trend over the 50-year planning period, which is the sum of the trends on each of the six land uses considered in the model.

b) Combining with other data

Another presentation option is to use the data in tandem with other data for calculating and presenting new information. An example of this is the calculation of government levies, which include those from forestry and coal mining activities.

Forestry levies include the reforestation fund and forest royalties. The reforestation fund was calculated from the amount of wood harvested, which included timber and pulpwood. The amount of timber harvested was extracted from the summary report for the whole district. In addition, there was timber from forest clearing for replanting into other croptypes, which is assumed to be 20 m3 per hectare cleared. The amount of cleared area was identified from the summary report, specifically from the magnitude of the clearing of natural forest for forest plantation, agricultural plantation, shifting

cultivation, and coal. The Government, as documented in Table IV.16, regulated the tariffs of levies.

Table IV.15: Types of data provided by FOLPI summary reports

Category		Year							
Mgt. Stage	Item	1	2	3	4	.	.	.	50
Intermediate	Area affected								
	Operational cost								
	Operational labour								
	Oilpalm harvest								
	Shifting cultivation revenue								
	Coal harvest								
	Overhead cost								
	Preparation cost								
Final	Area harvested								
	Wood (total), timber, pulpwood								
	Harvest revenue								
	Harvest cost								
	Harvest labour								
	Biodiversity index								
	Soil cost								
	Carbon stock								
Residual	Area left								
	Wood (total), timber, pulpwood								
	Harvest revenue								
	Harvest cost								
	Harvest labour								
	Biodiversity index								
	Soil cost								
	Carbon stock								

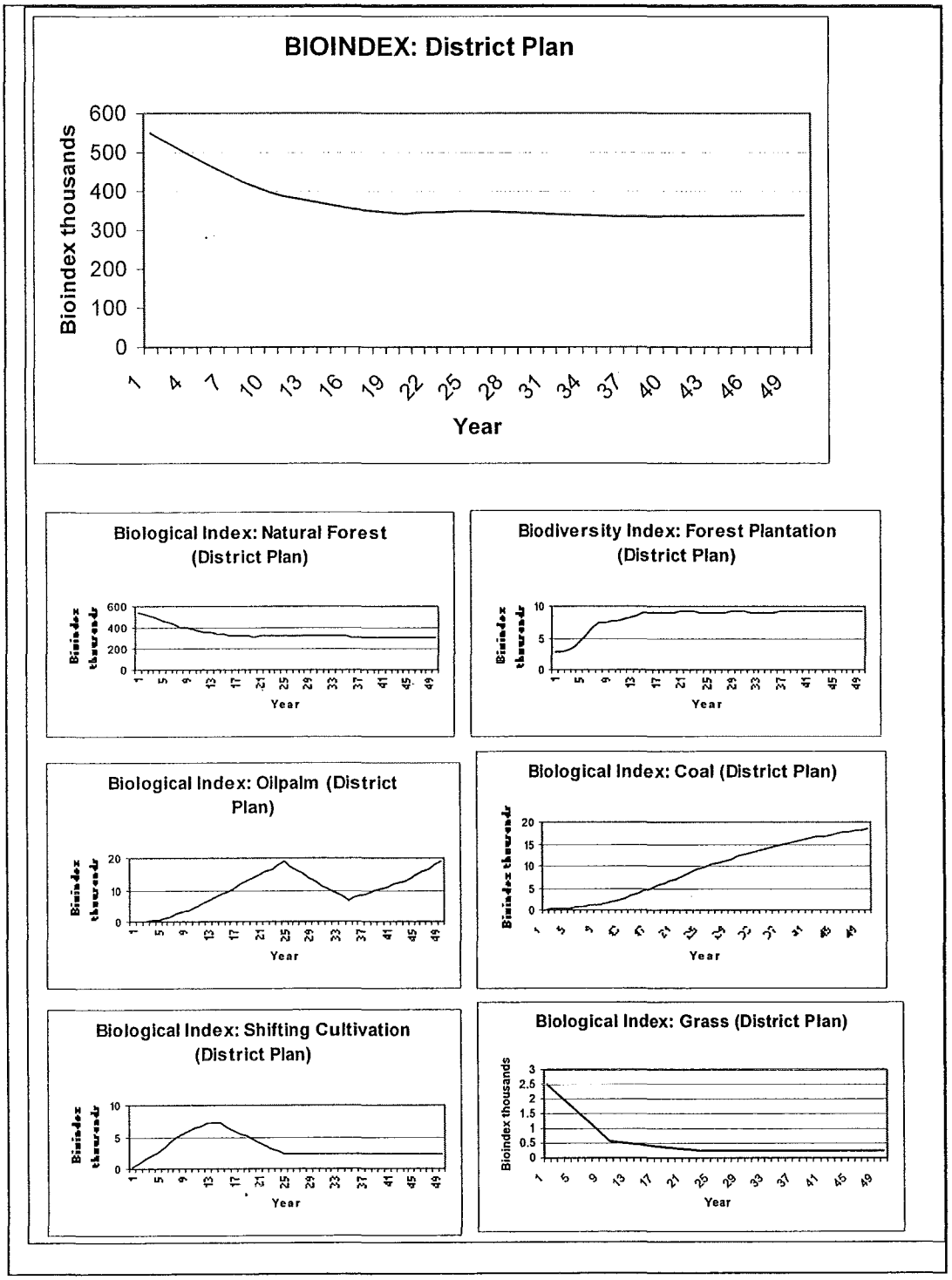


Figure IV.1: Graphs of Biodiversity Index Impacts of District Plan Scenario, the Total and Contribution of Each Land Use, from 2001-2050

Table IV.16: Tariff of levies for forestry and coal activities

Sector	Levy	Tariff	Regulation Reference
Forestry	Reforestation Fund for natural timber	14.5 US$/m3	Govt. Regulation No. 92/1999 (Bappenas 2000)
	Reforestation for Acacia mangium pulpwood	14.5 US$/m3	
	Royalty for natural timber	50,000 Rp/m3	Forestry's Letter Ref. 859/Kpts-II/1999 (Bappenas 2000)
	Royalty for acacia mangium pulpwood	2,500 Rp/m3	
	Licence fee for natural forest concession	50,000 Rp/ha	Government Regulation No. 58/1998 (Bappenas 2000)
	Licence fee for forest plantation	2,600 Rp/ha	
Coal	Royalty, high quality	7% of total sale value	Government Regulation No. 14/2000 (Bappenas 2000)
	Land rent	0.1 US$/ha	PT. Berau Coal data

The result of the contribution of tax, coal levies, and forestry levies under the Business as Usual scenario is presented in Figure IV.2. Tax here refers to the corporate tax, that is 30% of net revenue. That is calculated after reductions of expenditures, including forest and coal levies.

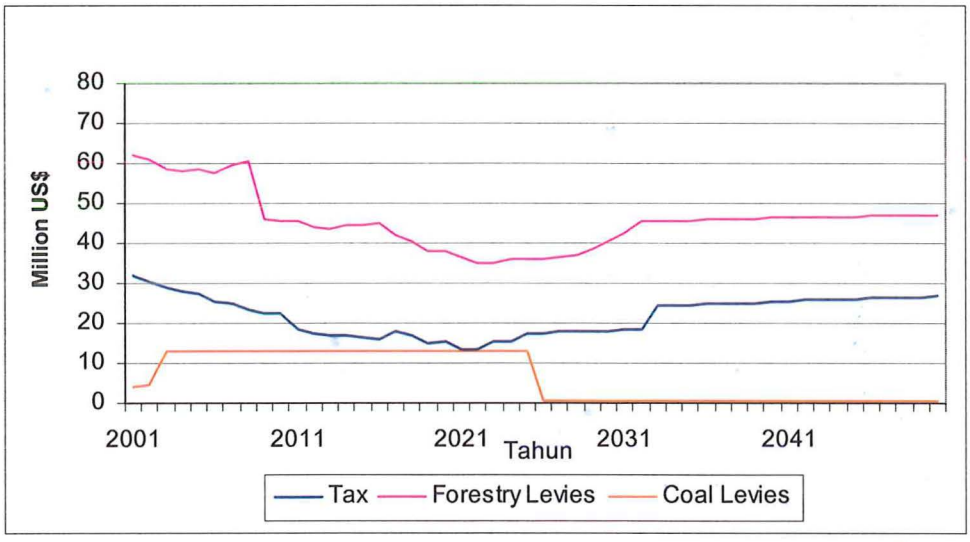


Figure IV.2: Tax, Forestry Levies, and Coal Levies in Berau District under the Business As Usual Scenario, from 2001-2050

The government income data can be further combined with data on the government revenues distribution among different levels of government. Such distribution is regulated in Act No. 25/1999, which is presented in Table IV.17 for both forestry and coal revenues. The resulting graph for forestry revenues appears as Figure IV.3. The line on the top represents the trend over the planning period of the total revenue from forestry, which is the total of the lines underneath, that represents the portions for central government, provincial government, local district government, and the other district governments in the same province.

Table IV.17: Distribution of Income from Natural Resources among Levels of Government according to Act No. 25/1999 (Bappenas 2000)

Activity	Central	Producing Province	Producing District	Other Districts in Province	Other Districts in Indonesia
Forestry, Royalty	20%	16%	32%	32%	0
Forestry, License	20%	16%	64%	0	0
Forestry, Reforestation Fund	60%	0	40%	0	0
Mining, Land Rent	20%	15%	64%	0	0
Mining, Royalty	20%	16%	32%	32%	0

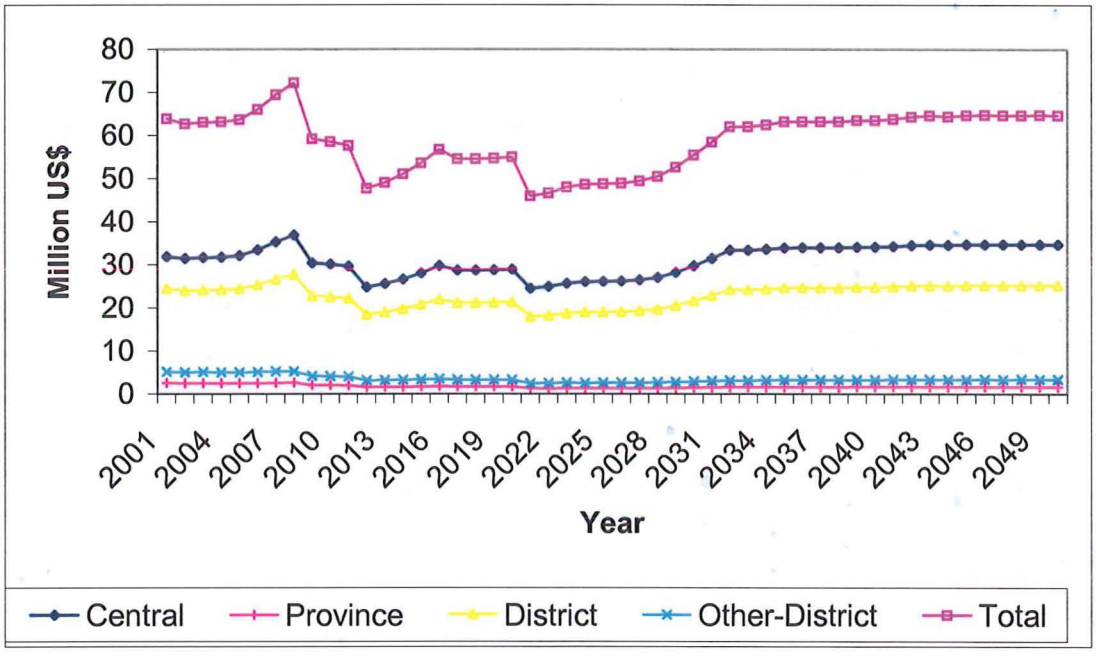


Figure IV.3: Forestry Government Revenue Distribution under Berau District Plan Scenario, from 2001-2050

H. Conclusion

This chapter tackles the question of the estimation of the impacts of land use planning scenarios. It offers a method that includes the establishment of a case study, interviewing the stakeholders regarding land use planning issues in their interest, identifying appropriate scenarios, and finally modelling the scenarios using FOLPI. The selection of Berau District as the case study site allows the use of much data previously developed by BFMP specifically, and supported by a study in a neighbouring area on ecological impacts of land use change.

The result is a visual presentation in graphs of the scenarios and their economic, ecological and social consequences. Such graphs could be numerous because FOLPI accepts any data on resources involved in each land use, and it can then report back on how the resources fare during the modelling period. From the reports, figures can be extracted for producing useful graphs, such as overall biodiversity index trends and the contribution of each land use, and different revenues accruing to the government and its distribution among levels of government.

Such graphs were required for the National Forestry Programme exercise that was the background of this study. The selection of graphs from among the numerous possibilities, and how to use them is the subject of Chapter VI.

CHAPTER V
Q METHODOLOGY
WITH VERBAL STATEMENTS

A. Introduction

This chapter presents the application of Q Methodology in the conventional way, i.e. using verbal Q statements. It is an attempt to answer the second research question in Chapter III, i.e. how to understand the stakeholders' preferences on land use planning. The reason for choosing this methodology was presented in Chapter III, so this chapter can go straight to the methodology itself.

First the methodology is described in terms of its history and principles, and then the procedure is laid down. Q methodology involves some statistical procedures, some of which are complicated, such as the factor analysis. Only the principles can be included here, and further details are found in major works in this field. Then the application in the Case Study is presented, following the procedures described earlier. The results are described and concluded at the end of this chapter, with a view to answering the research question mentioned above.

B. About Q Methodology

1. History and Principles

Q methodology was founded in 1935 by William Stephenson, who introduced the use of factor analysis for the study of subjectivity (Brown 1993). Subjectivity is understood here to mean a person's communication of his or her point of view (Brown 1986; McKeown and Thomas 1988). Stephenson's procedure involves a population of *n* tests subjectively measured by *m* persons. This is contrary to the traditional data form of a population of *n* persons objectively measured in *m* tests, which cannot be factor analysed between persons as the tests are normally in different units (e.g. height, intelligence). His first example was a set of colours (the population of n tests) rank-ordered by 10 persons in terms of their pleasingness. A factor analysis of the data revealed groups of persons who were similarly pleased by the same colours. This

finding can be checked with the persons in that group, hence it is a systematic study of subjectivity.

This invention did not easily win broad acceptance in the social scientific community. It received strong opposition, especially in its early development in psychology and psychometry. Other fields were more welcoming, starting with psychiatry. Half a century after its invention, even though there had been more than 1,500 bibliographic entries, Brown (1986) acknowledged that Q methodology was still among the "new tools for social scientists." McKeown and Thomas similarly held that "Q retains a somewhat fugitive status within the larger social scientific community" (1988: 11).

More recently, however, Q methodology gained increased popularity (Brown 1993). It has been used in many fields, such as: marketing, pharmacy, political science, child psychology, nursing and medicine, psychoanalysis, public policy, public administration, literary interpretation, and communication. Also, the bibliography has increased to nearly 2,500 entries. The development was supported by the Q devoted journal (Operant Subjectivity), society (ISSS - International Society for the Scientific Study of Subjectivity) with its annual conferences, electronic mail discussion list, and computer freeware packages for mainframe as well as PC platforms (Brown 1996).

Q Methodology is a bridge between the positivist policy analysis and postpositivist policy analysis. The former is mainstream and traditional and relies on positivism, objectivism, and decisionism. It uses sophisticated quantitative methods (R-methods). The latter praises aspirations toward more widespread participation in important policy decisions (Durning 1999). Postpositivists regard positivists as "purveyors of ineffectual advice and tools of tyranny", and positivists regard postpositivism as "a swamp of ambiguity, relativism, and self-doubt... creating more problems for the policy analysis business than it solves" (Durning 1999: 391). Amidst their opposing views, both sides claim Q methodology as theirs. On one side, the Postpositivists claim that "[A]nalysts who use Q-methodology would function, in part, as practicing Postpositivists" (Durning 1999: 391). On the other side, the Positivists claim that "Postpositivists... seem quite willing to embrace the quantitative Q-method" (Weimer 1999: 427). Robbins and Krueger (2000) noted that Q is a true mix of qualitative and quantitative method by allowing the respondents to participate in the construction and manipulation of the categories of a quantitative form of analysis. Being

a bridge between the two poles, Q methodology also has the combined advantage, i.e. the rigor of statistic analysis and the depth and intuitiveness of qualitative analysis.

2. Procedure and Techniques

Q Methodology involves the sorting of a set of items by a sample of people, the result of which is analysed to understand grouping among the people. The set of statements is selected from a concourse. These steps and elements are elaborated below.

a) Concourse

Concouse is "the volume of statements on a topic" (Brown 1997: 3). It consists of all statements that might be used in seeing and talking about a topic (Stainton Rogers 1995).

McKeown and Thomas (1988) differentiate the statements into naturalistic and ready-made. Naturalistic statements are collected from respondents' oral or written communication; those collected from sources other than respondents' own communication are ready-made. The interview is the most common method to collect naturalistic oral statements. Naturalistic written statements can be elicited from written narrative, either existing or specially asked to be written by respondents. Ready-made statements are labelled quasi-naturalistic if they are naturalistic but drawn from beyond the study, e.g. from interviews in another study. Also under the ready-made category are those statements drawn from standardized scales, such as conventional scales of ideological positions across the Left-Right spectrum, personality-descriptive traits, scales of alienation, self-esteem, and so on. A combination of naturalistic and ready-made statements is also possible and labelled hybrid, e.g. statements from an interview and from a newspaper. McKeown and Thomas hold that neither of these types of statement is superior to the other. It depends on the nature of the research.

The concourse statements "are collected to form as comprehensive and diverse a set as possible" (Addams 2000: 20). This does not appear to be an indefinite task as he further asserts that "interviews are conducted until (due to 'finite diversity') no new viewpoints are being encountered and the same comments are being repeated" (p.20). A clearer guide is given by Stainton Rogers (1995) with a hint that the number of statements is typically about three times the intended number for sorting.

b) Q Samples

The whole set of concourse statements are not used in Q sorting, but rather, a representative sample. They are typically presented on cards, and so in this text they are interchangeably called Q samples, Q statements, or Q cards. There are a number of criteria for representativeness:

- "Balance, appropriateness and applicability to the issue, intelligibility and simplicity, and comprehensiveness" (Addams 2000: 20);
- "Relevance derived by the researcher from available theory about the subject matter" (Fairweather and Swaffield 1994)
- "Richness, distinctiveness, salience, and representativeness" (Focht 2002: 1340);
- "A miniature which, in major respects, contains the comprehensiveness of the larger process being modelled" (Brown 1993: 99)

The common way to approach representativeness is by structuring the samples. The main device to structure the samples is to apply the design principle of factorial experimentation (McKeown and Thomas 1988; Brown 1993: 99; Addams 2000). The design can be deductive, i.e. based on *a priori* hypothetical or theoretical considerations, or inductive, i.e. emerging from the patterns that are observed as statements are collected (McKeown and Thomas 1988: 28).

An example of a deductive design is found in Coke and Brown (1976) and the theory of public opinion evaluation of Thompson (1886). To represent a concourse on land use, they refer to the theory of opinion and draw an emphasis on definiteness of opinion by categorising them into bias, wish and policy. Definiteness here refers to the gradation from opinions that are "held earnestly and on rational grounds", to those that "merely reflect a vague preference". These category series are increasingly stronger in "the extent to which it is the result of thought-out theoretical position" (p.99). In order to pursue representativeness they also use theoretical completeness as a frame. This involves reference to a chosen theory and taking the elements in the theories into account. For example, referring to a previous study on land use, they categorise opinions on land use into three positions: developmentalist, environmentalist, and cooperative. The resulting design is as in Table V.1. Such structure represents the theoretical position of the researcher and provides a focus and boundaries for the issue under study (Addams 2000).

An example of the inductive design is found in Brown (1993). Having a set of statements on commentary about Q methodology, Brown adopts the inductive approach when saying "While perusing the concourse, it was noted that some of the statements were of a technical nature" (Brown 1993: 99). He further noted that some statements are methodological. He also categorises the statements according to the intellectual heritage, i.e. Stephenson, Burt, and neither. These result in a 2x3 design with 6 cells.

Table V.1: Deductive Factorial Design Used In An Study Of Opinions On Land Use (Coke and Brown 1976)

Definiteness: Theoretical completeness:	Bias	Wish	Policy
Developmentalist			
Cooperative			
Environmentalist			

Statements in the concourse are then identified and entered into the suitable type, and about the same number of statements from each type are selected to form the Q samples. How many statements are taken from each type, hence how many statements in total, is a matter that also needs guiding references. Suggestions on a typical number of Q samples have given a range between 30 and 60 (Brown 1986: 59; Fairweather and Swaffield 1994: 8; Addams 2000: 22). This is not a rigid range, however, as Brown (1993: 99) has exemplified by the use of only 20 statements.

c) Respondents

In terms of the number of respondents, Q methodology can be either intensive or extensive. It is indeed intensive oriented and can involve small person-samples and single case studies, where the purpose is "to study intensively the self-referent perspectives of particular individuals in order to understand the lawful nature of human behaviour" (McKeown and Thomas 1988: 36). Participant selection is usually pragmatic, aiming to have the full diversity of opinion present in the discourse in order to identify all factors related to the topic of research (Coke and Brown 1976; Addams 2000).

Extensive Q methodology studies may involve a larger number of respondents, but normally still far fewer than in survey studies. As Brown asserts, "even in studies of public opinion, samples of persons rarely exceed 50" (1993: 34). A rare example is a study on gay-rights in McKeown and Thomas (1988), which involved 108 respondents. This number was obtained through a factorial design, as with the Q samples above. Four criteria were employed, three of which were demographic (sex, age, and education) and one theoretical (orientation group). They gave a total of 36 combinations, which were assigned 3 replications and resulted in 108 persons.

d) Q Sorting

Q sorting is "a process whereby a respondent expresses his or her point of view by rank-ordering Q samples according to a condition of instruction" (McKeown and Thomas 1988: 30). The condition of instruction would provide the continuum along which the statements are to be placed, such as from 'most agree' to 'most disagree'. It would typically also require a certain number of Q samples at each rank, so that they form a quasi-normal distribution. Quasi-normal means a symmetrical about the middle, but usually flatter than a normal distribution (McKeown and Thomas 1988; Brown 1993; Addams 2000). The logic is that most disliked statements are very important in a negative sense (Brown 1980), and so they are given the highest negative scores and not the smallest scores. However, McKeown and Thomas (1988) add that: "Even under free-choice conditions, significant deviations from normality are rare when the Q sample is sufficiently comprehensive in scope". Brown also maintains that "both the range (continuum) and the distribution shape are arbitrary and have no effect on the subsequent statistical analysis, and can therefore be altered for the convenience of the Q sorter" (Brown 1993: 102). He also gives a hint on the flatness of the distribution:

> "If the subject matter of the study is one in which most persons are expected to be relatively uninformed or uninterested, a distribution approaching normality is appropriate... With respect to highly controversial issues, on the other hand.... A more flattened distribution is generally employed since this provides more opportunities for responses at the extremes of the distribution and reduces the number of those in the center" (1980: 200).

The Q sorting administration involves writing the statements on small pieces of paper. A condition of instruction tells the respondents what is expected of them, such as "rank-order these statements from the one you most agree to the one you most disagree,

according to this distribution." The respondent is then asked to read the deck of statements through, and then sort them into three piles: positive, negative, and neutral. Next is refinement of the sorting, going from extreme right and left towards neutral in the centre. After finishing, the respondent is free to change the placement. An interview usually follows, in which the respondent is asked to explain the reasoning behind the ranking. During the interview the respondent can still change the sort. The interview is then recorded, and so is the final sort.

e) Analysis

The analysis of the data from Q sorts involves three statistical procedures (Addams 2000): calculation of a correlation matrix, extraction and rotation of significant factors to an acceptable solution, and computation of a set of factor scores for each factor. These steps are now performed by software packages such as the PQM[7]. The Q sort data are entered into the program, which intercorrelates them and factor analyses the intercorrelation matrix. The resulting factors are then rotated and for each of the final factors a sort is reconstructed. The analysis process in a computer does not take much time. The interpretation of the analysis result, however, requires basic understanding of the process, as is described below.

Correlation. In the Q technique, correlation coefficients are used to measure similarity between any two Q sorts. As established in statistical methods, correlation coefficients are usually calculated using the Spearman formula:

$$r_{xy} = \frac{\sum xy}{\sqrt{(\sum x^2)(\sum y^2)}}$$

where x and y are deviation scores around the mean of the respective scores in Q sorts X and Y. Because in Q technique the data distribution is forced into a quasi-normal distribution, the means and standard deviation are identical, William Stephenson has proposed an equivalent and more convenient formula (Brown 1980: 272-5):

$$r = 1 - \frac{\sum d^2}{2Ns^2},$$

[7] PQMethod is a statistical program tailored by Peter Schmolck to the requirements of Q studies, including facilities of easy data entering, inter sort correlation, and factor analysis. PQM is available electronically at http://www.rz.unive-muenchen.de/~p41bsmk/qmethod/pqmanual.htm.

where d is the difference in score for a statement in two different Q sorts, N is the size of the Q sample, and s^2 is the variance of the Q-sort distribution.

A correlation is significant when it exceeds 1.96 SE_r ($p < 0.05$) or 2.58 SE_r ($p < 0.01$), where *standard error* or $SE_r = 1/\sqrt{N}$ and N is the number of Q samples (Brown 1980: 283-4).

For an application with just a few sorts, correlation coefficients may be able to show which pairs of persons are highly correlated. This would not be the case with a larger number of respondents. Forty respondents, for example, would result in 780 pairs [n(n-1)/2] as well as the correlation coefficients, which are not easy to examine visually (Brown 1980). It is here that the service of factor analysis helps.

Factor Analysis. Factor analysis is a method for classifying variables, that is persons doing the Q sorts (Brown 1980). Using the information on similarities between pairs, factor analysis seeks to search for similarities more generally (Addams 2000). This method allows respondent groupings to emerge by way of similarity between members. These groupings are called factors, from which comes the name of the method.

There are a number of factor analysis methods. The centroid or simple summation method is computationally easy, and yet recommended for use in the Q technique (Brown 1980). There are two major components in factor analysis, i.e. factor extraction and factor rotation.

Factor extraction involves some manipulation of the correlation coefficients, as described in Brown (1980: 208-24). *First*, in order to account for as much of the variability in the original correlation matrix as possible, the correlation coefficient sum for each variable (person, sort) is made all positive through reflection. Reflection is the changing of the signs of the coefficients in the most negative variable sum, which continues until all sums are positive. The *second* manipulation is estimation of each variable's communality, i.e. "the percentage of a person's Q-sort response associated with the responses of the other subjects in the study" (Brown 1980: 211). It can start with coefficient average ($\bar{r}$) of each variable as the first estimate. The loading rate to a factor is calculated as $f = t/\sqrt{T}$, where t is the total of correlation coefficients of a variable (including the communality) and T is the grand total (of all variables) of correlation coefficients. When $f^2 \neq r$, the f substitutes r to get a new t, and a new f_2 is

calculated. The process continues until the new f is the same as the previous one. The saturation signifies emergence of the first factor, along with each sort's loading rate to the factor. The next factors are extracted in a similar way, but from a new table with the correlation coefficients now reduced by those of factor 1. These are not the final factors as they are subject to rotation, and so usually quite a few factors (such as the magic number 7, as used in PQM) are extracted.

Factor rotation involves the use of a different viewpoint to see the positions of variables and establish relationships among those variables. The positions of the variables are represented by the correlation coefficients

Factor rotation can be done either objectively or subjectively. Objective factor rotation does it on the basis of mathematical and statistical acceptability. The purpose is to maximise the purity of saturation of as many variables (Q sorts) as possible on one or the other of the factors extracted initially. It enhances orthogonality if the data support it (McKeown and Thomas 1988). It is "just as the regression line is positioned in a nonarbitrary way in the sense that its location minimizes the sum of the squared deviations about it" (Brown 1980: 224). Subjective rotation, also called abduction, "is based on the purpose of testing some hypotheses or following up hunches" (Brown 1980: 224). For example, analysts may consider a particular Q sort so important that they rotate the axis judgmentally to maximise its loading on one factor (McKeown and Thomas 1988).

Defining sorts of factors. As defined in PQM, defining sorts of factors are those whose loading exceeds 1.96 standard error (SEr), and that explains more than half of the common variance as expressed by the inequality $a^2 > h^2/2$, where a is factor loading and h^2 the sort communality[8].

The relations between sorts in relation to their affiliation with factors could be of different nature. Two sorts are orthogonal if they affiliate with different factors. They are in a bipolar relation if they affiliate with the same factor but at opposite poles, positive and negative. A sort may also be unaffiliated with any sort, i.e. it is idiosyncratic (Brown 1980).

Factor score. Factor scores are the weighted average of factor members' scores, and form composite sorts of factor members. The weight is calculated using the formula

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[8] Schmolck, P., PQMethod Manual. http://www.rz.univwmuenchen.de/~p41bsmk/qmethod/pqmanual.htm. Visited 25/6/2003.

$w = f / 1\text{-}f^2$, where f is the loading on the factor. For the purpose of comparability between factors with a different number of members, factor scores are usually normalised as z score:

$$z = \frac{T - \bar{X}_T}{s_T}$$

where T is the sum of factor scores, $\bar{X}_T$ is factor score average, and S_T is Standard Deviation. The z scores form the Factor's composite Q sort. The Q samples with the highest z scores get the highest rank, and so on.

Useful information about a Q statement's score is whether it is distinguishing a factor from the others. The clue is that two scores are significantly different if they differ by more than 2.58 SED[9] (standard error of differences), with:

$$SED_{X-Y} = \sqrt{SE_X{}^2 + SE_Y{}^2},$$

where,

$$SE = s_x\sqrt{1 - r_{xx}}$$

$$r_{xx} = \frac{0.80p}{1 + (p-1)0.80}$$

where SE is the standard error of factor scores; r_{xx} is the factor reliability; and p is the number of persons defining a factor (Brown 1980: 244-5).

f) Interpretation

In Q the scores assigned to statements in the composite sort are important, as they represent the factor's attitude (McKeown and Thomas 1988; Brown 1993). The attitude is derived from the "comparative positioning of items" in the factor's sort (Addams 2000: 32). All possible explanation could be attempted for the factor sort to reach the best explanation. Internal consistencies could also be sources of explanation. There is no set formula for presenting the interpretation and explanation of factors, but they are usually condensed as a label which best describe the factor (Addams 2000).

A possible interpretation could involve seeing the characteristics of each factor from the statements that distinguish them. Then the group of statements given the same

[9] The multiplier for the 0.10 level is 1.65, for the 0.05 level 1.96, and for the 0.001 level 3.29

score can be examined. Further interpretation can be based on information from follow up interviews with the respondents.

C. Q Application with Verbal Statements

The principles and procedures as described above were implemented in the context of land use planning for Berau District. There were two types of applications, i.e. one using verbal Q statements and the other using graphical Q statements. The former is the subject of the rest of this chapter, the latter is of the next chapter.

1. Concourse and Q Sample

A concourse on land use planning and its impacts was recorded from a series of interviews with key persons and relevant land use planning documents, which were collected during the period November 2001 – May 2002. The questions asked during the interviews were centred on two issues. One was the interviewees' opinions about ongoing land use changes and their consequences. The second one was their wishes for future changes or conditions related to land use changes. Forty nine people were interviewed, and two relevant meetings were attended. Respondents' points of opinions were recorded and, enriched with excerpts from relevant planning documents, became the concourse of the Q application in this Case Study.

The concourse was the basis from which to select the Q sample. The selection was deductive (see section 2.b above) and based on a factorial design. The design follows Coke and Brown's (1976) structure of land use opinions, which covers definiteness through the categories of bias, wish, and policy. The theoretical completeness was attempted through inclusion of economic, ecological and social aspects. These categories formed a matrix of nine cells, and 33 Q statements were selected from the concourse to fill up the matrix relatively evenly. The matrix with the statements appears as Annex 2. These statements were printed on cards 6 cm x 10 cm in size.

2. Trial of the Q Statements

The 33 qualitative Q Statements were used in trial interviews with eleven subjects in Jakarta. Representation of stakeholders was not emphasized at this stage.

Eight subjects were government officials, two from NGOs, and one from a private forestry company. Their sorts were recorded and their comments taped.

The sorts were then loaded into the software PQM, following a standard procedure, i.e. using centroid factor analysis, varimax rotation, and default identification of factors and their members. These resulted in four types of people, i.e. Social-Environmentalist, Business People with Environmental Awareness, Environmentalist-Pro-community, and Environmentalist.

The results showed that the Q application was feasible. However, it was noted from the subjects' comments that 33 cards were too numerous. Indeed, the interviews lasted thirty minutes up to two hours. It was decided to use the cards but with the number reduced to 22, which appears in Annex 3. The reduction was based both on the distinguishing rates of each statement, on the need to still keep them in balance according to the factorial design, and comments made by subjects. The distribution table was changed accordingly.

3. Interviews

Participants. Participants were purposely selected to assure complete coverage of different types. This was attempted through a matrix combining concerns representing theoretical completeness (economic, ecological, social) and geographical levels (central, provincial, district). The theoretical completeness refers to the aspects of sustainable development, which were assumed to cover all possible discourses on land use planning. Such coverage was attempted by purposively selecting the respondents, rather than doing it randomly. The matrix of participants appears in Table V.2.

Sixty seven respondents participated in the interviews in the months from June – August 2004. This included the eleven respondents in the trial exercise and two people who were contacted and responded by email. As the trial deck of statements were merely reduced in number from 33 to 22, the trial sorts could be reconstructed into the real exercise. In some cases it involved consulting the respondent again or the respondent's recorded explanation on the sorting. Table V.2 contains individuals in the government sector (18, including 4 researchers), private sector (19, including 5 from state companies), NGOs (19), universities (6), and community leaders (5). Geographically, 29 were from the district level, 19 from the provincial level and 19 from the central level. The portion of respondents representing the economic aspect turned

Table V.2: Factorial Design of Participants of Q Application with Verbal Q Statements

	Economic		Ecological		Social		Total
District	District Planning Officers, Production Officers	5	Environment NGOs	5	Dayak people reps	1	29
	State and private companies and associations	11			Community reps	3	
					Local-Parliament members	1	
					Social NGOs	3	
Province	Planning Officers	1	Universities	1	University	1	19
	University	3	Researcher	1	Researcher	2	
	Private company	4	Env. NGO	4	Social NGO	2	
Central	Planning/Production Officers	8	Environmental NGO	3	Social NGO	2	19
	Private company	5	Researcher	1			
Total		37		15		15	67

out to be higher (37) than those of the other two aspects. Many of them were government officers, and it would later appear that not all of them actually emphasised the economic concern.

Interview Administration. To build trust and to avoid misunderstanding, an information sheet was provided. It briefed the respondents on the general purpose of the research, and assured them of the confidentiality of their response.

The participants rank ordered the Q statements into a quasi-normal distribution. The distribution used in this study appears in Table V.3. The condition of instruction for sorting was: "Rank order the 22 statements from the one you most disagree (score -4) to that with which you most agree (score 4) according to the following distribution table." It took between 20 and 90 minutes for the participants to do the sorting. The sorts were recorded, and a voice-recorded interview followed each sorting to clarify the reasoning behind the sort.

4. Results

The 67 sorts were entered into the PQM, and subjected to the Centroid factor analysis and Varimax rotation. Hand rotation was not administered because the intention was to study the general perception of stakeholders without any strongly developed theoretical leads to types of perception of land uses (Fairweather and Swaffield 1994).

Table V.3: Distribution for Rank-Ordering of the Verbal Q Statements

-4	-3	-2	-1	0	1	2	3	4

With 22 Q statements, in order to be significant a Q sort's factor loading needs to exceed 0.42, which is 1.96 SE_r (at $p < 0.05$) where the *standard error* or $SE_r = 1/\sqrt{22}$. Of the 67 respondents, after rotation 59 had statistically significant loadings on one of three factors. The number of factors was determined by the criteria of at least two significant loadings (Brown 1980).

The three factors were labelled as: Pro-environment (factor 1), Pro-community (factor 2), and Pro-business (factor 3). These labels were drawn from an analysis and interpretation of their agreed and disagreed statements and distinguishing statements. Stakeholders orthogonally loaded to the factors, i.e. none of them loaded to the same factor bipolarly. The membership of the factors is presented in Figures V.1 and V.2, where the government background also include the researchers, and the business background covers both private and state companies.

Figure V.1 shows that the Pro-environment had the largest membership, followed by the Pro-community, and least was the Economist. The Economist, however, was purely loaded by business people. The Pro-environment consisted of all sorts of professional background, the greatest number was from the NGO, followed by government, business, and university. The Pro-community also contained people of different background, though the community representatives had a significant number.

Figure V.2 shows affiliation to the factors by each professional background. Most of those with government background were affiliated with the Pro-environment; only a few with the Pro-community. The NGO and university people were similarly distributed. Business people appeared to be evenly affiliated with the three factors. The community leaders very consistently affiliated themselves with the Pro-community.

The characteristics of each factor are described below.

a) The Pro-environment

Factor Sort. The composite sort of the Pro-environment Factor is shown in Table V.4.

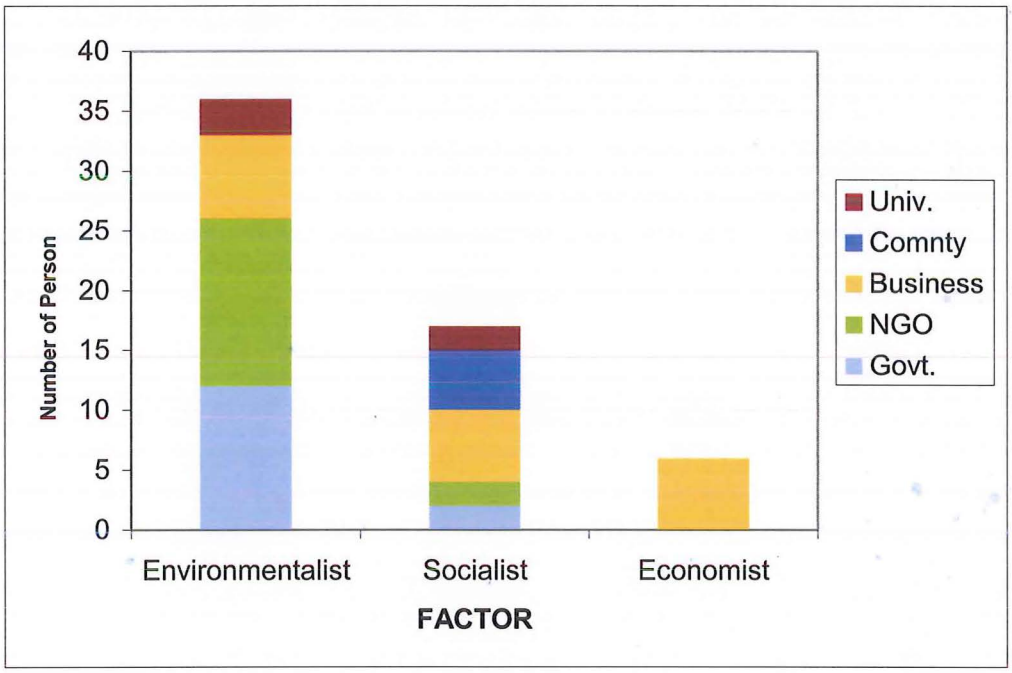

Figure V.1: Membership of the Verbal Q Factors

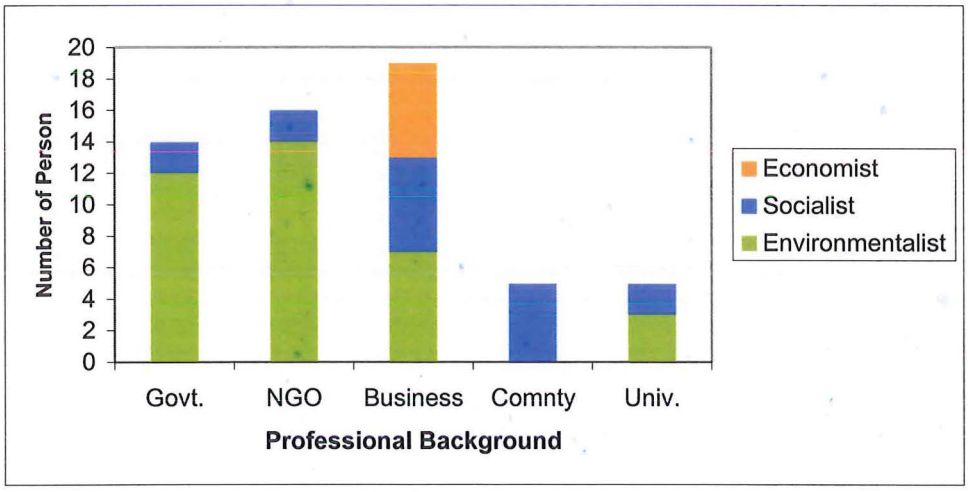

Figure V.2: Verbal Q Factor Affiliation of Each Professional Background

A way to see how this factor is different from the others is by looking at their distinguishing statements, as presented in Table V.5. This time the figures are presented in z-scores, because the rounded figure for the scores may sometimes fail to show differences between factors.

Factor Characteristics. Tables V.4 and V.5 shows that stakeholders in this factor are very clear in expressing their concern about the environment. The most agreed statement (z-score 1.77) was number 22, which received a low score of 0.56 and –0.14 in factors 2 and 3 respectively. This means that those in this factor strongly wanted enforcement of the Environmental Impact Assessment in order to achieve sustainable natural resources utilization. This was supported by their strong view on the protection of forests, such as that expressed in statement 21 on the idea that forest and agricultural plantations should be established on unforested lands (z-score 1.22, 3). Another supporting view was on the need to leave much forest intact (statement 9, z-score 0.89, rank 3), and to exploit the non timber forest products such as medicinal plants (statement 15, z-score 0.79, rank 2) and carbon absorption value (statement 10, z-score 0.70, rank 1). This factor is worried about the increasing threat of flooding (statement 20, z-score 0.80, rank 2 and statement 13, z-score 0.70, rank 1) and about lack of clear water due to industrial activities (statement 16, z-score 0.75, rank 1).

This factor's environment-leaning views were also expressed through their negative scores for statements in favour of resource exploitation , such as statement 1 (z-score –1.88, rank –4), statement 4 (z-score –1.41, rank –3), and statement 2 (z-score –1.47, rank –3). Consistently they are against exploiting companies, such as statement 8 (z score –0.89, rank –2) and statement 7 (z-score –0.36, rank –1) which highly value large scale business investment, and statements 6 which is in favour of business than local people (z-score-0.80, rank –2).

In between the preference for environmental issues and refusal to resource exploitation was their relatively neutral views on the socially leaning statements. For instance, statements 14 which favours greater access of the local people to the natural resources was assigned z-score 0.42 and rank 0, and statement 12 on the need for companies to employ local people got z-score 0.35, rank –1. Similarly, the view on granting land title to shifting cultivators that was contained in statement 19 was given z-score –0.29, rank –1.

Table V.4: The Composite Sort of the Pro-environment Factor

-4	-3	-2	-1	0	1	2	3	4
1. Economic development is a key to people's prosperity. The Government should therefore allow maximum natural resource exploitation. Environmental concern comes next.	4. Companies need to have enough profits in order to survive and keep contributing to development. Therefore environmental and social expenses need to be minimized.	6. The Government must secure that natural resource management businesses can run without too many economic claims from communities.	19. As an incentive against short fallow shifting cultivation, land title should be granted for farmers practicing sustainable shifting cultivation.	14. They say this region is rich in natural resources. I would like it reflected in the welfare of the people. The benefits need to be distributed in a more appropriate manner.	16. Clean water is very important for the local people. Any natural resource development activity must adopt techniques that avoid local water pollution, at any cost.	15. The forest is a rich source of medicinal plants with potentially great value. I'd like to see the resources preserved by reducing forest harvesting, and then the medicinal value explored to replace the timber value.	21. We need to enforce that new forest and agricultural plantations can only be established on lands with little vegetation, not on forested lands that are clear cut for the timber revenue.	22. Environmental Impact Assessment has been there to make sure natural resource development is sustainable. Its implementation needs to be strictly enforced. Severe sanctions need to be applied for any violation.
	2. Human being is most favourable creatures on earth. Therefore most important is people's welfare, and environmental concerns must not be a constraint.	8. The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	7. Natural resources utilization is important for improving people's prosperity. Therefore, the government should give more incentives for investment in this field.	12. Companies should be required to employ more local people. They should also spare special budget for training the locals so they are up to the job.	10. I have heard of people getting money because their vegetation can absorb carbon. I want to see that happen here in this region. And for that reason I would like to see this area remain richly vegetated.	20. Land use plans must assure that such impacts like flooding due to over clearing of forests are avoided. Land uses with high erosion risk must be minimized.	9. Our land use plan should leave much forest intact.	
		5. More than anything else, in natural resource development we need to have continuous supply of production of timber, oilpalm, etc. Communities' prosperity and environmental sustainability can be considered next.	3. People need to earn good living. Where there is no alternative source of living, such local people activities like unsustainable shifting cultivation and illegal logging should be allowed as long as they are not commercialised by investors.	11. It's all very well having modern natural resource development, but if local people don't benefit it's no good.	13. I am worried that flooding may result from over exploitation of natural resources in this region, as has been happening in many places in Indonesia.	18. The government must make sure that companies' community development programmes do improve people's prosperity.		
				17. For the sake of people's prosperity, labour intensive companies should be given more support than the capital intensive ones.				

Table V.5: Distinguishing statements of the Pro-environment Factor

	Distinguishing Statement	Z-score of Each Type		
		1	2	3
22	Environmental Impact Assessment is made to secure that natural resources utilization is sustainable. Its implementation needs to be strictly enforced. Severe sanctions need to be applied to all violations.	1.77	0.56	-0.14
21	We need to enforce that forest plantations and agricultural plantations be established only on lands with minimum vegetation, not on forested lands to be cut for timber revenue.	1.22	0.40	0.66
9	Our forest land use planning must leave much forest intact.	0.89	-0.35	-1.44
16	Clean water is very important for the local people. Any natural resource development activity must adopt techniques that avoid local water pollution, at any cost.	0.75	0.19	0.15
10	I have heard of people getting money because their vegetation can absorb carbon. I want to see that happen here in this region. And for that reason I would like to see this area remain richly vegetated.	0.74	0.19	-0.96
13	I am worried that flooding may result from over exploitation of natural resources in this region, as has been happening in many places in Indonesia.	0.70	-0.09	-0.38
17	For the sake of people's prosperity, labour intensive companies should be given more support than the capital intensive ones.	-0.23	0.36	1.30
7	Natural resources utilization is important for improving people's prosperity. Therefore, the government must give more facilities for investment in this field.	-0.36	-0.06	1.88
6	The government must secure that natural resources utilization business can run without being too much being disrupted by economic claims by local people.	-0.8-	-1.20	1.69
8	The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	-0.88	-1.31	0.99

Factor members. This was the majority type of stakeholders, with 33 significant loadings. Their background and intensity of affiliation to this factor is presented in Table V.6.

In terms of professional background, it was logical that the largest portion of this factor's members came from NGOs, with 14 respondents. This represents 80% of the total number of respondents from NGOs. The other major background was the Government, with 12 respondents including 2 researchers. They represented 71% of respondents with Government background and half the Government researchers. The average loading by each occupational background indicated that NGOs were second only to the researchers, who seem to be very strong in their concern about the environment.

Interestingly the private sector was well represented in the Pro-environment factor, with 3 from state companies (out of 5) and 4 from private companies (out of 15). There are at least two possible reasons for their significance loading. One possibility is that, while being part of a company exploiting natural resources, they

were genuinely concerned about the environment. The other possibility is that the sort was not made genuinely for some reason. A hint may be gotten by further examining their loading to the other factors, and their background. Their overall loading is presented in Table V.7.

Table V.6: Loading to the Pro-environment Factor by Members with Different Occupational Backgrounds (in brackets are respondent code numbers, in bold are the highest)

NGO	Govern-ment	Govt. Re-search	State Comp.	Private Comp.	Commun-ity	Univers-ity.
(7) 0.77	(16) 0.69	**(14) 0.94**	**(5) 0.78**	(10) 0.44	-	(1) 0.77
(8) 0.75	(25) 0.57	(58) 0.83	(11) 0.54	(31) 0.47		(3) 0.65
(9) 0.56	(44) 0.61		(42) 0.67	**(41) 0.87**		(43) 0.70
(12) 0.66	(48) 0.56			(45) 0.47		
(19) 0.80	(56) 0.59					
(21) 0.66	**(57) 0.83**					
(22) 0.70	(59) 0.62					
(37) 0.83	(61) 0.66					
(38) 0.69	(66) 0.71					
(46) 0.83	(67) 0.56					
(47) 0.79						
(53) 0.67						
(55) 0.67						
(63) 0.67						
(Average) 0.71	0.64	0.88	0.66	0.56	-	0.71
(No. of Res-pondents) 14	10	2	3	4	0	0

While these respondents have economic based profession, only sorts 10, 11, 31, and 42 loaded rather strongly, though not significantly, to the Economic factor. The rest, however, loaded very weakly, or even negatively to the Economic.

Further source of information on these contentious sorts was the arguments behind the sort, which were presented during follow up interviews. As an example, sort 41 was provided by an individual in the environmental division of a resource extraction company with a forestry education and career background. His sort is as in Table V.8.

Table V.7: Overal loading of the Pro-environment factor members with Private Company background

Code	Loading			Backgound
	Pro-environment	Pro-community	Economic	
5	0.78	0.15	-0.05	State company, production
11	0.54	0.39	0.31	State company, community development
42	0.67	0.39	0.32	State company, production
10	0.44	0.07	0.31	Private company, general affair division
31	0.47	0.34	0.21	Private, production
41	0.87	0.30	-0.01	Private, environment division
45	0.47	0.45	-0.05	Private, community development

Table V.8: Sort number 41

-4	-3	-2	-1	0	1	2	3	4
1	5	2	17	15	12	21	9	22
	4	6	14	19	13	16	10	
		8	3	7	18	20		
				11				

His arguments included the following:

> "I disagree the most with statement 1.... As natural resources are exploited at the maximum level, the benefits may not trickle down... Only big investors or certain people would enjoy it..."
>
> "...plantations.... cause erosion problems, which cost more than the benefits..."
>
> "Local community would continue to lay claim to companies because in our country the tenure system is not good. The social welfare is not yet good, so local people need a ride..."
>
> "Too much emphasis on the economic aspect while neglecting the ecological aspect... would cause flooding, landslides, etc, which would carry even greater costs."

> "I agree the most with the Environmental Impact Assessment, especially with enforcement of sanctions... As a company person, I don't mind. It would be better if laws are enforced."
>
> "I also agree with the idea of leaving much forest intact... It should not be a problem for resource extraction industries in this district, as there are forested buffer areas."

This person's views confirmed his sort. He seemed to detach himself from his profession and talked as purely Pro-environment. This phenomenon is inevitable in the context of a public discourse such as a development of land use planning scenario. In the context of definiteness of views, i.e. bias, wish and policy (Coke and Brown 1976), some stakeholders' opinions at the bias and wish level may be different from their view of policy. It is interesting in the graphical Q application presented in the next chapter, that this respondent also affiliated himself with the Pro-environment.

b) The Pro-community

Factor Sort. The composite sort of the Pro-community Factor is as in Table V.9. The unique preference of statements of this factor is presented in Table V.10.

Factor Characteristics. This type of stakeholder was in favour of the local communities. More than the other factors, they supported modern natural resource utilization only if it benefited the local people (statement 11, z-score 1.70, rank 4). This was supported by their support for increased access to natural resources by local people (statement 14, z-score 1.65, rank 3), for companies to employ local people (statement 12, z-score 1.14, rank 3), and for good community programmes (statement 18, z-score 0.93, rank. They even agreed (z-score 0.41, rank 1) with statement 19 on the need to give land title to shifting cultivators, an issue that was negatively scored by the other two factors. They did not see shifting cultivation as a threat to the environment, because when done properly it is sustainable and suitable for the traditional local people.

Consistently the Pro-community did not agree on statement 6 about the Government preventing local communities from claiming their rights against business companies (z-score –1.2, rank -2). This factor did not accept the idea of minimising social expenses in favour of companies' survival (statement 4, z-score –1.45, rank –3). They also did not believe that the existence of large companies (statement 8)

would automatically bring prosperity to the local communities (z-score –1.31, rank -2).

Against all the pro-community views, they were neutral on the need to support labour intensive companies (statement 17, z-score 0.36, rank 0). The post-sorting interviews, however, revealed that local employment was not really an issue in Berau District. The population was relatively so small compared to the size of the region that some people were even worried about the negative effects of in-migrating labour.

Their inclination to the community side, however, does not mean that they are ready to sacrifice the environment. They disagreed (z-score –1.20. rank -2) with the idea of sacrificing natural resources for the welfare of people (statement 2), though at an intensity less than that of the other factors (–1.47 and –1.49). Similarly, negative scores were given to statements favouring natural resources exploitation, such as statement 1 (z-score –1.8, rank -4) and statement 5 (z-score –1.307, rank –3) .

This factor placed environmentally friendly statements in between the socially friendly statements on the positive sides and the pro-exploitation statements on the negative sides. Statement 10 on carbon values were given 0 rank (z-score 0.19), just like statement 16 on the importance of clear water (z-score 0.19). Also placed in the middle were statement 22 on Environmental Impact Assessment (z-score 0.56, rank 1), statements 21 and 9 on saving forests from conversion (z-score 0.40, rank 1 and z-score –0.35, rank –1, respectively), statement 15 on medicinal plant values (z-score 0.79, rank 2), and statements 20 and 13 on flooding avoidance (z-score 0.62, rank 2 and z-score –0.09, rank –1, respectively).

Factor members. There are seventeen significant loadings to this factor, with the occupational background and strength of affiliation as in Table V.11. As expected, all respondents with community backgrounds produced defining sorts of the Pro-community Factor. Their loading average was also high, again only second to the strong-viewed researchers. Surprisingly NGOs were not well represented in this factor, with only two respondents significantly loading to it. Companies, on the contrary, were quite well represented, with two from state companies and four from private companies. Further observation of their background showed that they were or had been associated with community development in their career.

Table V.9: The Composite Sort of the Pro-community Factor

-4	-3	-2	-1	0	1	2	3	4
1. Economic development is a key to people's prosperity. The Government should therefore allow maximum natural resource exploitation. Environmental concern comes next.	5. More than anything else, in natural resource development we need to have continuous supply of production of timber, oilpalm, etc. Communities' prosperity and environmental sustainability can be considered next.	2. Human being is most favourable creatures on earth. Therefore most important is people's welfare, and environmental concerns must not be a constraint.	13. I am worried that flooding may result from over exploitation of natural resources in this region, as has been happening in many places in Indonesia.	17. For the sake of people's prosperity, labour intensive companies should be given more support than the capital intensive ones.	22. Environmental Impact Assessment has been there to make sure natural resource development is sustainable. Its implementation needs to be strictly enforced. Severe sanctions need to be applied for any	18. The government must make sure that companies' community development programmes do improve people's prosperity.	14. They say this region is rich in natural resources. I would like it reflected in the welfare of the people. The benefits need to be distributed in a more appropriate manner.	11. It's all very well having modern natural resource development, but if local people don't benefit it's no good.
	4. Companies need to have enough profits in order to survive and keep contributing to development. Therefore environmental and social expenses need to be minimized.	6. The Government must secure that natural resource management businesses can run without too too much being disrupted by economic claims by local people.	9. Our land use plan should leave much forest intact.	0. I have heard of eople getting money ecause their vegetation an absorb car-bon. I vant to see that happen ere in this region. And or that reason I would ke to see this area emain richly vegetated.	19. As an incentive against short fallow shifting cultivation, land title should be granted for farmers practicing sustainable shifting cultivation.	15. The forest is a rich source of medicinal plants with potentially great value. I'd like to see the resources preserved by reducing forest harvesting, and then the medicinal value explored to replace the timber value.	12. Companies should be required to employ more local people. They should also spare special budget for training the locals so they are up to the job.	
		8. The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	. People need to earn good living. Where here is no alternative ource of living, such ocal people activities ike unsustainable hifting cultivation and llegal logging should e allowed as long as hey are not comer- ialised by investors.	16. Clean water is very important for the local people. Any natural resource development activity must adopt techniques that avoid local water pollution, at any cost.	21. We need to enforce that new forest and agricultural plantations can only be established on lands with little vegetation, not on forested lands that are clear cut for the timber revenue.	20. Land use plans must assure that such impacts like flooding due to over clearing of forests are avoided. Land uses with high erosion risk must be minimized.		
				. Natural resources tilization is important or improving people's rosperity. Therefore, he government should ive more incentives for nvestment in this field.				

Table V.10: Distinguishing Statements of the Pro-community Factor

	Distinguishing Statement	Z-score of Each Type		
		1	2	3
11	Modern natural resources utilization is good but no use if the local people do not benefit.	0.19	1.70	-0.18
14	They say this region is rich in natural resources. I would like it reflected in the welfare of the people. The benefits need to be distributed in a more appropriate manner.	0.42	1.65	0.20
12	Companies should be required to employ more local people. They should also spare a special budget for training the locals so they are up to the job.	0.30	1.14	0.24
22	Environmental Impact Assessment has been there to make sure natural resource development is sustainable. Its implementation needs to be strictly enforced. Severe sanctions need to be applied for any violation.	1.77	0.56	-0.14
19	As an incentive against short fallow shifting cultivation, land title should be granted for farmers practising sustainable shifting cultivation.	-0.29	0.41	-0.50
17	For the sake of people's prosperity, labour intensive companies should be given more support than the capital intensive ones.	-0.23	0.36	1.30
10	I have heard of people getting money because their vegetation can absorb carbon. I want to see that happen here in this region. And for that reason I would like to see this area remain richly vegetated.	0.74	0.19	-0.96
7	Natural resources utilization is important for improving people's prosperity. Therefore, the government must give more facilities for investment in this field.	-0.36	-0.06	1.88
9	Our forest land use planning must leave much forest intact.	0.89	-0.35	-1.44
2	Human beings are most favourable creatures on earth. Therefore most important is people's welfare, and environmental concerns must not be a constraint.	-1.47	-0.92	-1.49
6	The government must secure that natural resources utilization business can run without too much being disrupted by economic claims by local people.	-0.80	-1.20	1.69
8	The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	-0.88	-1.31	0.99

Table V.11: Loading to the Pro-community Factor by Members with Different Occupational Backgrounds (in brackets are respondent code numbers)

No	NGO	Govern-ment	Govt. Re-search	State Comp.	Private Comp.	Commu-nity	Universit y.
1	(18) 0.70	(23) 0.62	(15) 0.74	(6) 0.69	(39) 0.44	(17) 0.59	(3) 0.51
2	(54) 0.69			(62) 0.64	(40) 0.63	(27) 0.71	(64) 77
3					(49) 0.78	(28) 0.66	
4					(52) 0.65	(29) 0.80	
5						(30) 0.82	
Average	0.70	0.62	0.74	0.67	0.63	0.72	0.64
Respondent Number	2	1	1	2	4	5	2
Respondent Total	17	14	4	5	15	5	6

c) The Pro-business Factor

Factor Sort. The composite sort of the Pro-business Factor is as in Table V.12. The unique preference of statements of this factor is presented in Table V.13. Obviously this type of stakeholder fancied any idea supporting natural resource utilization such as statements 7, 6 and 8 (ranks 4, 3, and 2 respectively). It might look unnatural to see this factor scoring high (rank 3) on statement 17 which supports labour intensive companies at the expense of capital intensive ones. The follow up interviews, however, revealed that the reason for this position was that labour intensive resource management was cheaper than capital intensive resource management.

Also understandably, this factor did not support (z-score –0.14, rank 0) the idea of enforcing implementation of the Environmental Impact Assessment (statement 22). They were also least impressed (z-score –1.44, rank –3) by the idea of leaving much forest intact (statement 9), and (z-score –0.96, rank –2) seeing the area remaining richly vegetated for its speculative carbon absorption value (statement 10). However, they are also not prepared (z-score –0.54, rank –2) to go blindly exploiting natural resources by sacrificing the environment and the local communities (statement 4). Similarly, statements that support natural resources exploitation were given lower scores, such as statement 4 (z-score –1.45, rank –2), statement 2 (z-score –0.92, rank –3), and statement 5 (z-score –1.31, rank-2). They are economic driven but have some ecological and social responsibilities.

Table V.12: The Composite Sort of the Economist Factor

-4	-3	-2	-1	0	1	2	3	4
1. Economic development is a key to people's prosperity. The Government should therefore allow maximum natural resource exploitation. Environmental concern comes next.	9. Our land use plan should leave much forest intact.	4. Companies need to have enough profits in order to survive and keep contributing to development. Therefore environmental and social expenses need to be minimized.	13. I am worried that flooding may result from over exploitation of natural resources in this region, as has been happening in many places in Indonesia.	16. Clean water is very important for the local people. Any natural resource development activity must adopt techniques that avoid local water pollution, at any cost.	21. We need to enforce that new forest and agricultural plantations can only be established on lands with little vegetation, not on forested lands that are clear cut for the timber revenue.	8. The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	6. The Government must secure that natural resource management businesses can run without too too much being disrupted by economic claims by local people.	7. Natural resources utilization is important for improving people's prosperity. Therefore, the government should give more incentives for investment in this field.
	2. Human being is most favourable creatures on earth. Therefore most important is people's welfare, and environmental concerns must not be a constraint.	10. I have heard of people getting money because their vegetation can absorb carbon. I want to see that happen here in this region. And for that reason I would like to see this area remain richly vegetated.	3. People need to earn good living. Where here is no alternative source of living, such local people activities like unsustainable shifting cultivation and illegal logging should be allowed as long as they are not comercialised by investors.	5. The forest is a rich ource of medicinal lants with potentially reat value. I'd like to ee the resources preerved by reducing orest harvesting, and hen the medicinal value xplored to replace the mber value.	12. Companies should be required to employ more local people. They should also spare special budget for training the locals so they are up to the job.	20. Land use plans must assure that such impacts like flooding due to over clearing of forests are avoided. Land uses with high erosion risk must be minimized.	17. For the sake of people's prosperity, labour intensive companies should be given more support than the capital intensive ones.	
		5. More than anything else, in natural resource development we need to have continuous supply of production of timber, oil-palm, etc. Communities' prosperity and environmental sustainability can be considered next.	19. As an incentive against short fallow shifting cultivation, land title should be granted for farmers practicing sustainable shifting cultivation.	22. Environmental Impact Assessment has been there to make sure natural resource development is sustainable. Its implementation needs to be strictly enforced. Severe sanctions need to be applied for any	14. They say this region is rich in natural resources. I would like it reflected in the welfare of the people. The benefits need to be distributed in a more appropriate manner.	18. The government must make sure that companies' community development programmes do improve people's prosperity.		
				11. It's all very well having modern natural resource development, but if local people don't benefit it's no good.				

Table V.13: Distinguishing statements of the Economic Factor

No	Distinguishing Statement	Z-score of Each Type		
		1	2	3
7	Natural resources utilization is important for improving people's prosperity. Therefore, the government must give more facilities for investment in this field.	-0.36	-0.06	1.88
6	The government must secure that natural resources utilization business can run without too much being disrupted by economic claims by local people.	-0.80	-1.20	1.69
17	For the sake of people's prosperity, labour intensive companies should be given more support than the capital intensive ones.	-0.23	0.36	1.30
8	The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	-0.88	-1.31	0.99
15	The forest is a rich source of medicinal plants with potentially great value. I'd like to see the resources preserved by reducing forest harvesting, and then the medicinal value explored to replace the timber value.	0.86	0.79	-0.12
22	Environmental Impact Assessment is made to secure that natural resources utilization is sustainable. Its implementation needs to be strictly enforced. Severe sanctions need to be applied to all violations.	1.77	0.56	-0.14
4	Companies need to get enough profits in order to survive and keep contributing to development. Therefore, expenses for environmental conservation and local community development need to be minimized.	-1.41	-1.45	-0.54
10	I have heard of people getting money because their vegetation can absorb carbon. I want to see that happen here in this region. And for that reason I would like to see this area remain richly vegetated.	0.74	0.19	-0.96
9	Our forest land use planning must leave much forest intact.	0.89	-0.35	-1.44

Factor members. Membership of this factor was quite straight forward. All six of them were from private or state companies. Their loadings are recorded in Table V.14.

d) Consensus issues

Despite all the differences described above, there are also elements of consensus between them, which was ranked on the basis of the variance across normalized factor scores. They are presented in Table V.15.

All three factors agreed (all scored 2) that companies' community development programmes must improve people's prosperity (statement 18), and (all scored 2) that over clearing of the forests must be avoided (statement 20). They also shared disagreement on the idea of sacrificing the environment in favour of people's prosperity (statement 1, scores all –4), of continued supply of products (statement 5, scores –2 –3 –2), and even, albeit of low importance, of people's survival (statement 3, scores all –1).

Table V.14: Loading to the Pro-business Factor by Members with Different Backgrounds (in brackets are respondent numbers, in bold are the largest)

No	NGO	Govern-ment	Govt. Re-search	State Comp.	Private Comp.	Commu-nity	University.
1				(34) 0.54	(32) 0.45		
2					**(35) 0.72**		
3					(36) 0.60		
4					(51) 0.58		
5					(60) 0.70		
Average				0.54	0.61		
Respondent Number	0	0	0	1	5	0	0
Respondent Total	17	14	4	5	15	5	6

Table V.15: Most Consensual Statements

No	**Statement**	**Rank**		
		Factor 1	**Factor 2**	**Factor 3**
18	The government must make sure that companies' community development programmes do improve people's prosperity.	2	2	2
1	Economic development is a key to people's prosperity. The Government should therefore allow maximum natural resource exploitation. Environmental concern comes next.	-4	-4	-4
20	Land use plans must ensure that such impacts as flooding due to over clearing of forests are avoided. Land uses with high erosion risk must be minimized.	2	2	2
5	More than anything else, in natural resource development we need to have a continuing supply of production of timber, oilpalm, etc. Communities' prosperity and environmental sustainability can be considered next.	-2	-3	-2
3	People need to earn a good living. Where there is no alternative source of living, such local people's activities like unsustainable shifting cultivation and illegal logging should be allowed as long as they are not commercialised by investors.	-1	-1	-1

e) Disputed issues

There are also issues on which the three factors did not agree, as presented in Table 5.16. These are also based on the variance across normalised factor scores but at the opposite end from the consensus. It is this evaluation across factors that differentiates it from the identification of distinguishing statements of each factor, that emphasised the position of one factor as compared to the rest.

Table V.16: Most Disputed Statements

No	Statement	Rank		
		Factor 1	Factor 2	Factor 3
6	The Government must secure that natural resource management businesses can run without too much being disrupted by economic claims by local people.	-2	-2	3
8	The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	-2	-2	2
7	Natural resources utilization is important for improving people's prosperity. Therefore, the government should give more incentives for investment in this field.	-1	0	4
9	Our land use plan should leave much forest intact.	3	-1	-3
11	It's all very well having modern natural resource development, but if local people don't benefit it's no good.	0	4	0

On the idea that local communities should not disturb businesses with claims, the Pro-business Factor (score 3) was challenged by the Pro-environment (score –2) and the Pro-community (score –2). The case was similar to the idea that large companies bring prosperity to the communities, with the Pro-business scoring 2 and the rest both –2. The same thing happened with the Pro-business's claim (score 4) for support from the Government because natural resource utilisation improves people's prosperity, which was challenged by the Pro-environment (score –1) and the Pro-community (score 0).

On the other hand, the Pro-environment's conviction (score 3) that much forest should be left intact was challenged by the Pro-business (score –3) and also by the Pro-community (score –1).

The strong belief of the Pro-community (score 4) that natural resource development should benefit the locals was not severely challenged. The other two factors were just not ready to express support, both scoring 0.

D. Conclusion

This chapter has presented an application of the Q Methodology that used verbal Q statements. The Q Methodology application has resulted in some answer to the question of "how to understand stakeholders' preferences for land use planning". The application used Q sort data to lead to groupings of stakeholders along with their preferences. There were three factors or types of stakeholders in the Case Study. They were the Pro-environment, the Pro-community, and the Pro-business.

The Pro-environment position was based on 36 sorts, or more than half of the total of 67 sorts. Most of the members of this factor had an NGO or government background. Some, however, were from the business sector. This was likely because of their personal views beyond their professional stance. As the name implies, stakeholders of this type were very concerned about the environment. They wanted to see the Environment Impact Assessment enforced, the forest disturbance minimised, so that non-financial benefits such as flood avoidance and clear water supply are sustained. They were against large scale natural resource utilization.

The Pro-community position was based on seventeen sorts. The core members had a community background, but all sorts of backgrounds were represented here. Their main aspiration was to see the community prosper from the use of natural resources in the area. Like the Pro-environment, the Pro-community were also in opposition to natural resource utilization businesses.

The Pro-business had six members who were all from the business sector. Naturally their major drives were to secure their business through the mechanisms of government incentives, including maintaining security amidst many social conflicts.

The three factors had both contrasts and similarities of views. The obvious conflicting interests were between the Pro-environment and the Pro-community on one side and the Pro-business on the other side. The former were in favour of

environmental sustainability and social welfare, which meant costs to the rent-seeking Pro-businesss. All three factors, however, agreed on a few issues, including their disagreement in blindly sacrificing the environment in the pursuit of economic development, and on the common wish to minimise flooding risk. These joint and opposing views between the three factors can be summarised as in Figure V.3.

The verbal Q application thus has provided some insights into the groupings of stakeholders, as well as their normative preferences regarding land use planning. It would be interesting to see how the constellations of persons and views fared when the land use planning issues were presented quantitatively in the forms of graphs of scenarios and their consequences. That is the subject of the next chapter.

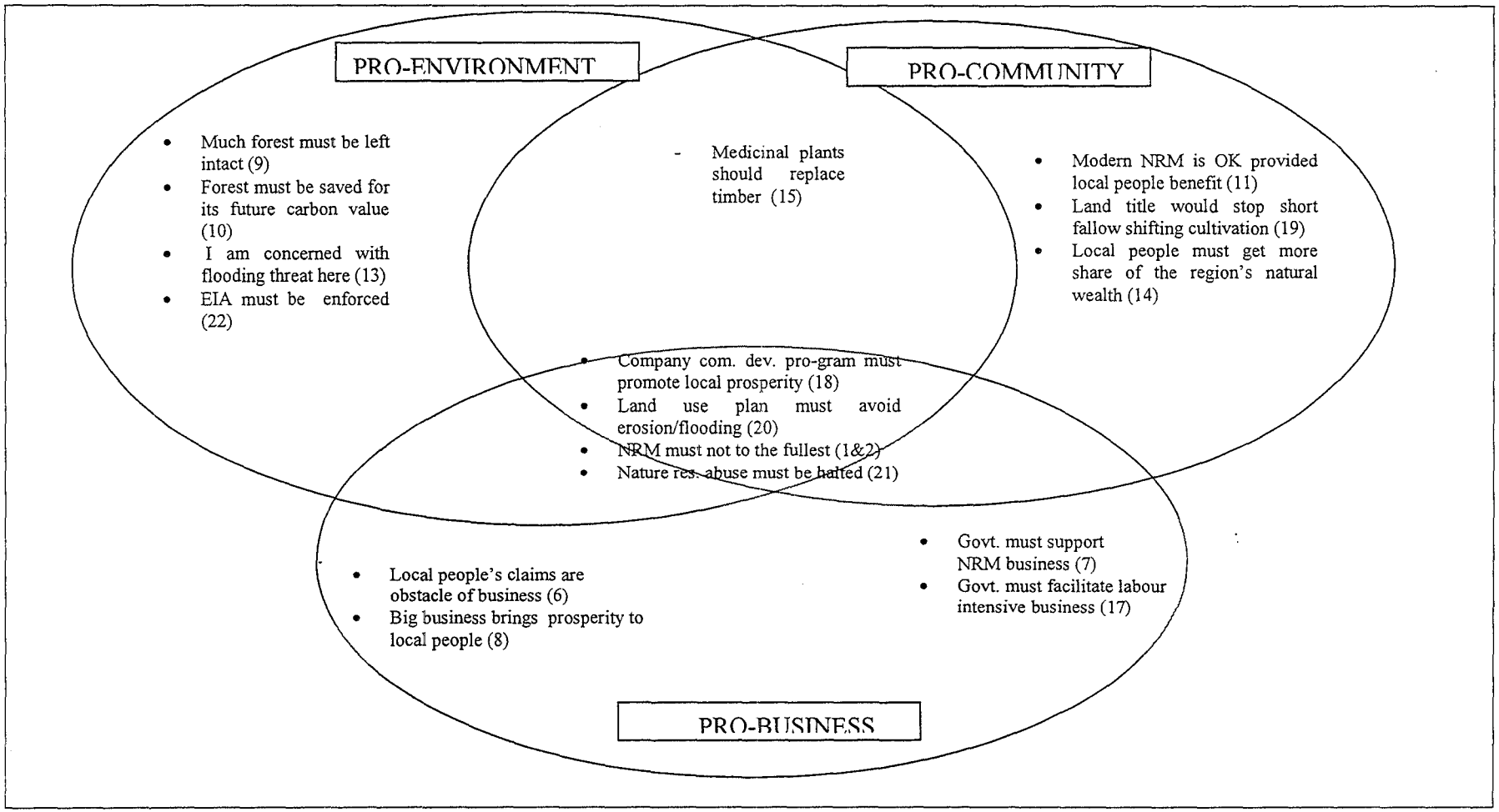

Figure V.3: Joint and Contrasting Views Between Verbal Q Factors

CHAPTER VI
Q-METHODOLOGY
WITH GRAPHICAL STATEMENTS

A. Introduction

This chapter takes up the third and last research question identified in Chapter III, i.e. "How to use quantitative presentation of land use plans and their consequences for understanding stakeholders' preferences". The method offered involves a Q-methodology application using graphs on the Q cards, which is unconventional. Graphs have been used to see if subjects change their sorts of picture samples in a Q application on land use option preferences in the Mackenzie/Waitaki Basin of New Zealand (Fairweather and Swaffield 1994; Fairweather and Swaffield 1996; Hock et al. 2001; Te Morenga et al. 2001). The use of the graph itself as Q samples in this application is an attempt to see if such an application is feasible and what can be learnt from it.

This chapter is based on the previous two chapters. The graphs used on the Q-cards were derived from the scenario modelling presented in Chapter IV. The Q-methodology having been described already in Chapter V, this chapter goes straight to the procedures and techniques as used in this application, to be followed by the presentation of results and its discussion.

B. Procedure and Techniques

1. Concourse and Q Samples

The concourse of this graphical Q application was based on that of the verbal Q application presented in Chapter V. It contains the stakeholders' points of views on land use planning and the impacts, which were recorded during a series of interviews. However, as the Q samples were in the form of graphically presented scenarios, the concourse also cover the graphical information produced through scenario simulation as presented in Chapter V.

a) Factorial design

A factorial design was devised with a view to represent the concourse. The design differentiates the scenarios in terms of their leaning towards economic, ecological, or social aspects. The factorial design appears in Table IV.1 of Chapter IV, which contains the following six scenarios:

scenario 1 "economically sound, socially medium, ecologically poor"
scenario 2: "economically sound, ecologically medium, socially poor"
scenario 3 "socially sound, economically medium, ecologically poor"
scenario 4 "socially sound, ecologically medium, economically poor"
scenario 5 "ecologically sound, economically medium, socially poor"
scenario 6 "ecologically sound, socially medium, economically poor"

In addition to the six scenarios, two others were included as the Q samples.

scenario 7 "economically sound, ecologically medium, socially medium"
scenario 8 "economically medium, ecologically poor, socially poor".

Scenario 7 was the Berau District Land Use Plan 2001-2011, which was still in draft at the time the data was obtained in 2001. Scenario 8 was the Business As Usual scenario, which depicted what would happen if the trend from 1997 – 2000 continued until 2050.

b) Graphs for the Q-cards

Chapter IV presents the development of scenarios with the characters as described in the factorial design. Therefore, this chapter proceeds with presentation of the scenarios as graphical Q samples.

The graphical Q cards contained selected information produced through the FOLPI model runs. The model runs reported on the resource dynamics of each croptype, or groups of croptypes during the 50 year modelling period. The resources involved included inputs and outputs in different units such as monetary, volume, weight, etc. The types of data available in FOLPI summary reports are summarised in Table IV.15. They offer a great deal of information, which forms part of the concourse.

With the aim of studying stakeholders' preference on land use planning while considering its different impacts, information items were selected from the concourse.

An imperative element to be included was the land use changes under the scenario. The remaining elements should be the different impacts, including the economic, ecological and social impacts. An example of the graphical Q cards appears as Annex 4. It contains four parts: land use dynamics, and the three types of impacts: economic, ecological, and social.

The land use dynamics of the scenario were represented by area changes of each land use over the 50 year planning period. The changes were presented in graphs, but for clarity they were accompanied by some verbal description.

The economic impacts of the land use scenario were presented in two graphs. One was the harvest revenue, i.e. the volume of monetary resources involved. Revenues should be a clear indicator of development, which is of interest for many stakeholders as expressed during the preliminary interviews. They were presented as a stacked area graph in order to show the contribution of each land use as well as their total. The other economic impact graph was on the government revenue in the forms of corporate tax and levies. The levies were from forestry activities and coal mining. This kind of impact was interesting for stakeholders with a government background, who were important in the land use decision making. The three indicators can be contained in a single graph because they were in the same monetary unit.

The ecological impacts were expressed in three indicators, i.e. biodiversity index, soil erosion cost, and carbon stock. These were indicators that should be interesting for people who fancy the total economic value concept. Because of the difference in units, i.e., biodiversity index unit, US dollar, and ton Carbon, these three indicators cannot be presented in a single graph.

The social impacts were represented by two indicators. One was the volume of jobs arising from each scenario, which was expressed in manday millions. This was the total of job opportunities arising from all land use activities under the scenario. The other social impact indicator was the rate of shifting cultivation. The two types of shifting cultivation were included, i.e. the long-fallowed, sustainable one and the short-fallowed, unsustainable one. The preliminary interviews indicated that some saw shifting cultivation is inevitable and good for the society, and some were not impressed at all.

Altogether there were eight graphs and one box of verbal description. They were each presented on a piece of A3 card. There were eight cards for the eight scenarios.

2. Interviews

a) Subjects

The subjects of the graphical Q application were a selection of those doing the verbal Q application in the Case Study. Not all of them could do the graphical card sorting because of the higher level of difficulty in comprehending the information. The community leaders at the village levels, for example, were not suitable because of the required understanding of the complicated graphs. On the other hand, many highly intellectual people would not agree to do the sorting because it would have taken them more time than the verbal Q sorting did. Some subjects tried doing it on the computer screen, which was more difficult than sorting the physical cards. The other disadvantage of the absence of the interview was that clarification on the graphs could not be done directly. Some email clarifications did take place, but they were not as intensive as in face to face interviews.

A total of seventeen subjects did this Q sort subsequent to their completing the verbal Q sorting. They were all university graduates. Their occupational background included NGO (4 subjects), Government (3), state company (3), private company (4) and university (3). Geographically 6 of them were from the district level, 6 from the provincial level, and the remaining 5 from the capital level. For comparison purposes, Table VI.1 shows how the seventeen subjects fit in the factorial design of participants as used in the verbal Q application and presented in Table V.2.

It appears that the economic aspect was most represented among the subjects. The ecological aspect was adequately represented with five subjects. The social aspect missed representation. As in the verbal Q application, however, all government officers were entered into the economic category regardless of individual characteristics and responsibilities, which may lean towards the ecological or social aspect. Indeed 3 of the 17 subjects affiliated themselves with the Pro-community in the verbal Q application. One of them was from a university, the other two from companies.

b) Procedure

As in the verbal Q interview, an information note was also presented to the subjects. Basically it contained some general information on the research purpose, what

Table VI.1: Factorial Design of Participants of Q Application with Graphical Q Statements

	Economic		Ecological		Social		Total
District	District Planning Officers, Production Officers	1	Environment NGOs	1	Dayak people reps	-	6
	State and private companies and associations	4			Community reps	-	
					Local-Parliament members	-	
					Social NGOs	-	
Provinces	Planning Officers	1	Universities	-	University	-	6
	University	2	Researcher	-	Researcher	-	
	Private company	1	Environment. NGO	2	Social NGO	-	
Central	Planning/Production Officers	2	Environment NGO	2	Social NGO	-	5
	Private company	1	Researcher	-			
Total		12		5			17

was expected to be done, and especially an assurance of confidentiality. Background information on the graphs was also prepared for the interview, such as a graph of the land use structure at the start of the modelling period, and a more detailed verbal description of the land use changes.

The subjects were then asked to rank order the eight scenarios from the most agreed with to the least agreed with. This was deemed simpler than asking them to sort them into the quasi normal distribution. Besides, this would allow their treatment as survey data, i.e. through averaging them as described fully in section E below. They were recommended to look at one card and were briefed on the lay out. They usually asked for some clarification on how the graphs were derived. Such questions were usually satisfied by describing an input and output database for each land use, to be interrogated by the computer. The second and subsequent cards were then examined

and rank ordered. It usually took an hour to complete the process, though some requested to take the cards home and came back with their sort and arguments. The interviews on the sort and arguments were voice recorded for analysis purposes. In some cases the subjects chose to provide the arguments in writing, and so the interview was unnecessary.

The simple ranks of the eight scenario were later rearranged into a 1-2-2-2-1 quasi-normal distribution. For example, rank 1 would fill the single cell of column 1, ranks 2 and 3 would fill the two cells in the second column., and so on. This was done to allow a Q analysis in order to learn the pattern of grouping of the subjects.

c) Sorting difficulty

The Q sorting was apparently more difficult in this application than in the verbal Q application. Scenario consequences were presented in seven graphs, and some graphs contained not only single information. These proved to be quite complicated. Of the 67 subjects doing the verbal Q sorts, about 25 were deemed suitable for the graphical Q sorting. This was due to either their intellectual capability or their time availability, and finally 17 of the 25 approached did the sorts. The low level of response was most likely caused by the level of complication of the sorting. That level of complication can indeed be adjusted, as the graphs are models of the land use plans and their consequences. Such reality is extremely complex and the models try to represent them in more simple ways. How simple they can go is a matter of a trade off between the level of reality to be presented and the comprehensibility of the information presented.

C. Three-factors Analysis

As with the verbal Q application, the seventeen Q sorts were entered into PQM and subjected to the standard procedure of centroid factoring and varimax rotation. The only modification was the relaxing of the threshold for loading significance from 0.70 to 0.66 to allow consideration of the third factor to include two significant loadings, the minimum number according to the criteria used here. When the threshold is lowered to 0.60, the third factor had a third significant loading. This would mean reduction of the confidence level to lower than 95%, which was deemed acceptable in this study in order to learn more about the stakeholder grouping.

1. Factors and the Members

a) Significant loading

At a confidence level of 95%, 13 sorts have significant loading to one of the factors. With the relaxation of the level of confidence, three more subjects could be included in the analysis, leaving only one idiosyncratic sort.

b) The factors

The 16 sorts clustered into three factors, which could be labelled (1) Conservative, (2) Responsible Resource Use, and (3) Economic Scale. The loading of each member to the three factors can be observed in Table VI.2, and their occupational background in Table VI.3 and Figures VI.1 and VI.2.

Table VI.2: Factor Loadings of the Graphical Q Application (defining sorts in bold)

Sort Number	Conservative	Responsible Resource Use	Economic Scale
1	0.24	**0.80**	0.31
2	**0.88**	0.12	0.35
3	-0.12	**0.78**	-0.19
4	0.35	**0.70**	0.19
5	0.58	**0.67**	-0.10
6	-0.33	-0.04	0.55
7	**0.73**	-0.35	0.17
8	0.26	**0.79**	0.40
9	0.04	0.50	**0.60**
10	**0.90**	0.14	-0.14
11	**0.72**	0.12	-0.41
12	0.16	0.11	**0.67**
13	**0.86**	0.16	0.25
14	**0.85**	0.31	0.08
15	**0.87**	0.43	0.11
16	**0.78**	0.44	0.14
17	0.23	0.07	**0.73**

Table VI.3: Factors in the Graphical Q Application, and the Occupational Background of the Members

No	Background	Conservative	Responsible Resource Use	Economic Scale	Total
1	NGO	3	-	1	4
2	Government	1	2	-	3
3	State company	1	2	-	3
4	Private company	3	-	-	3
5	University	-	1	2	3
	Total	8	5	3	16

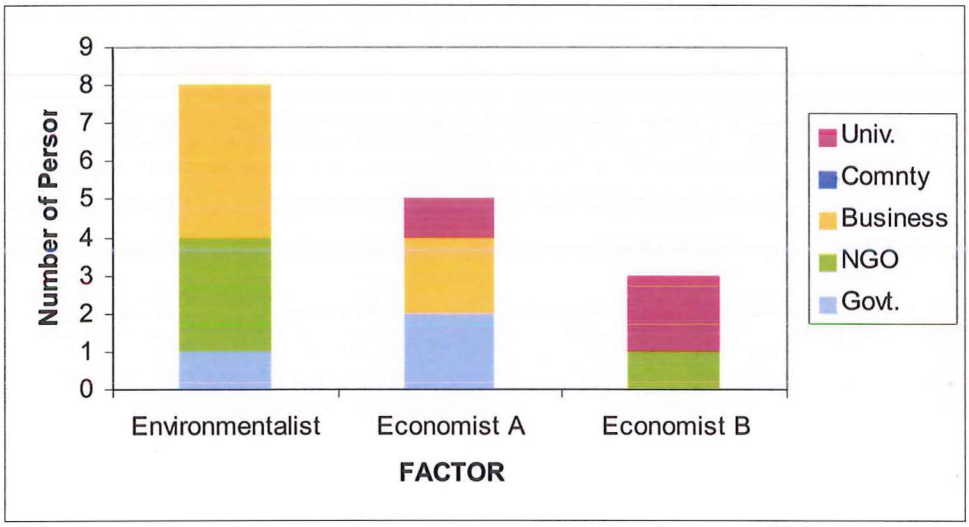

Figure VI.1: Professional Background Membership of the Graphical Q Factors

Table VI.2 and Figure VI.1 show how the subjects affiliated themselves with the environmental and economic poles of concern. Most significant loading by NGO stakeholders were to the Conservative factor. The government stakeholders were divided between the Conservative and the Responsible Resource Use, which could be because of the diverse characteristics of its many staff. State company stakeholders were in the Economist-A factor, while the fact that one of them was in the Conservative factor may need further observation of his role in the company. It appears that both

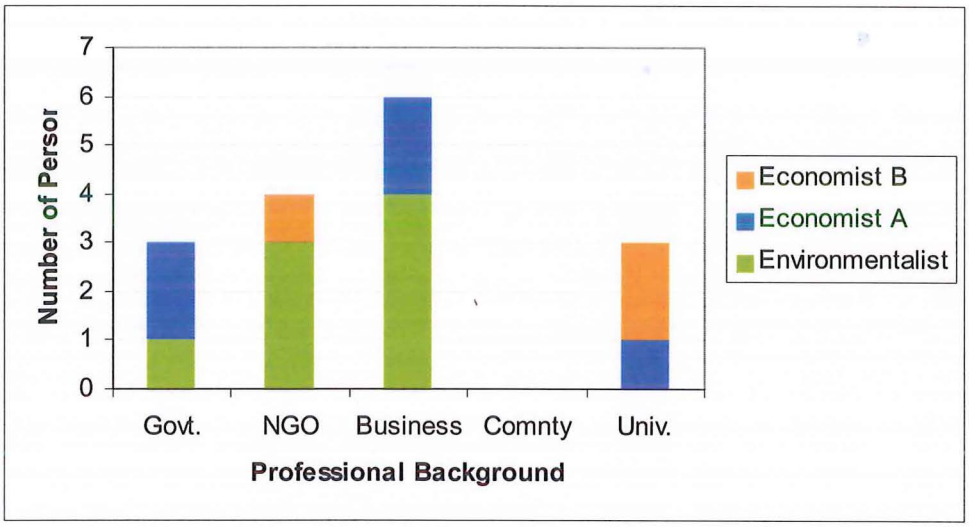

Figure VI.2: Graphical Q Factor Affiliation of Each Professional Background

significant loadings from university stakeholders were with the Economic factors. More interestingly, all three stakeholders from the private companies were in the Conservative factor, which was against expectation. Discussion of these apparent anomalies is presented later in Section VII.E.

2. Factors' Preference

a) The Conservative

Factor Sort The composite sort of this factor is as follows:

-2	-1	0	1	2
8	1	4	6	5
	3	7	2	

This factor placed the two environmentally friendly scenarios in the positive end of the continuum:

scenario 5 "ecologically sound, economically medium, and socially poor" (2)

scenario 6 "ecologically sound, socially medium, and economically poor" (1).

Next in their priority list is the economic concern:

scenario 2: "economically sound, ecologically medium, socially poor" (0)

scenario 7 "economically sound, ecologically medium, socially medium" (0).

scenario 1 "economically sound, socially medium, ecologically poor" (-1)

The social concerns were scored relatively low:

scenario 4 "socially sound, ecologically medium, economically poor" (0)

scenario 3 "socially sound, economically medium, ecologically poor" (-1)

Example Subject number 10 had the strongest affiliation with the Conservative factor. A government officer in a conservation division, he was known as being among those most genuinely concerned with environmental issues. His sort was as follows:

-2	-1	0	1	2
1	8	7	6	5
	3	4	2	

In doing the sorting, he chose to take home the graphical Q cards overnight. He came back with a table showing how he systematically ranked the eight scenarios. First he randomly picked scenario 7 and evaluated from the economic, ecological, and social aspects. He tabulated his observation on how the scenarios fare in each aspect, including the critical values and the general trend. He then randomly picked another scenario, this time number 4. Again he evaluated it using the same criteria as he used for the previous scenario. He compared the two and decided which he liked better. Then he took the next scenario, evaluated it and decided where it fit between the ones he had already rank ordered. He continued until the last scenario.

He placed both ecologically friendly scenarios (5 and 6) at the positive end of the continuum. The next preference was for scenarios 2 and 7 which were economically friendly, and further to the neutral/negative position were scenarios with social concerns (3 and 4). He also listed his arguments for the rank order:

"Environmental costs and social costs are important considerations in the decision making."

"In the Indonesian situation job opportunities will be important in the next 10 years."

"The ending condition in 2050 is important to consider in the decision making."

He was a government officer with sound integrity. His official responsibility in conservation might also have formed his sense of urgency for conservation. He was firstly concerned about the ecological situation of natural resources in the country. His

next concern was with the economic aspect, most likely due to the government's role as an agent of development. Consequently for him the social aspects came last.

b) Responsible Resource Use

Factor Sort. The composite sort of this factor is as follows:

-2	-1	0	1	2
8	7	6	1	2
	3	4	5	

The label Resource Use was given to this factor for its higher scores for scenarios in favour of economic concerns:

scenario 2: "economically sound, ecologically medium, socially poor" (2)

scenario 1 "economically sound, socially medium, ecologically poor" (1).

In line with the favourite scenario 2, next in priority was the ecological concern, with their medium scores for ecologically friendly scenarios:

scenario 5 "environmentally sound, ecologically medium, socially poor" (1)

scenario 6 "environmentally sound, socially medium, ecologically poor" (0)

The social concern came last, with socially friendly scenarios given lower scores:

scenario 3 "socially sound, economically medium, ecologically poor" (-1)

scenario 4 "socially sound, ecologically medium, economically poor" (0).

Example Sort 1 had the strongest affiliation with this factor. He was a lecturer in forest harvesting. His sort was as follows:

-2	-1	0	1	2
8	3	7	5	2
	4	6	1	

He gave high scores to economically friendly scenarios numbers 2 (score 2), 1 (score 1), and 7 (score 0). His next priority was the ecological aspect, by scoring rather favourably on scenario 5 (score 1) and scenario 6 (score 0). The social aspect was valued low, and both social aspect scenarios number 3 and 4 scored –1. Among his

comments were that he preferred "scenarios with relatively high economic performance, low in negative ecological impacts, and low in shifting cultivation."

c) Economic Scale

Factor sort The composite sort of this factor was as follows:

-2	-1	0	1	2
8	5	2	1	7
	3	4	6	

This factor was, like the Responsible Use factor, in favour of the economic concerns. This was expressed by their highest scores for economically friendly scenarios:

scenario 7 "economically sound, ecologically medium, socially medium" (2)
scenario 1 "economically sound, ecologically medium, socially poor" (1)
scenario 2 "economically sound, socially medium, ecologically poor" (0)

The ecological concern gained the next priority:

Scenario 6 "ecologically sound, socially medium, economically poor" (1)

The other ecologically friendly scenario, however, did not get a higher score:

Scenario 5 "ecologically sound, economically medium, socially poor" (-1)

The socially friendly scenarios were in between the two ecologically friendly scenarios:

Scenario 4 "socially sound, ecologically medium, economically poor" (0)
Scenario 3 "socially sound, economically medium, ecologically poor" (-1)

Example The strongest affiliation to this factor was by sort 17. He was a lecturer in resource management. His sort was as follows:

-2	-1	0	1	2
8	5	1	2	7
	3	4	6	

His arguments included the following:

> "I like scenario 7 especially because the sum of financial resources is high. Then the biodiversity index increases or at least flattens. Soil damage decreases. Carbon stock increases. Job opportunities are quite high."
>
> "I don't like scenario 8 because the sum of financial resources is not too high, and yet the biodiversity index decreases and soil damage increases. Carbon stock, maybe related to the biodiversity, also decreases."
>
> "Increasing the area of sustainable shifting cultivation is my interest."

He really liked scenarios with the highest total revenue. He was especially interested in having the total figure of revenue of each scenario for comparison.

d) Difference between Responsible Resource Use and Economic Scale

Details While both Responsible Resource Use and Economic Scale factors were in favour of the economic aspects, they had different consideration for the details. For example, while Economic Scale emphasized the total figure of revenue, Responsible Resource Use was not pleased without seeing the trend as well. This factor especially did not like any rough trend, even if it was positive. On scenario 7 ("Economically sound, ecologically medium, socially medium") Responsible Resource Use scored –0.79 while Economic Scale scored 1.09. As a member of the Responsible Resource Use factor commented:

> "Scenario 7 is socially risky because of the drop in job opportunities. The shifting cultivation fluctuation is also a potential problem. Economically it starts high but then declines. It is least preferred."

Economic Scale, on the other hand, emphasized the total, regardless of the trend.

> "I like scenario 7 especially because the sum of financial resources is high."

Other aspects They also give a different emphasis to the other aspects. The following are their scores for the two ecologically friendly scenarios.

> Scenario 5 "ecologically sound, economically medium, socially poor" (A: 0.75, B: -0.61).
>
> Scenario 6 "ecologically sound, socially medium, economically poor" (A: 0.00, B: 0.68).

When the ecological aspect was secured, Responsible Resource Use gave a higher priority to the economic aspect than to the social aspect. Economic Scale was the opposite. In fact, the strongest affiliating respondent, Sort 17, was a member of the

verbal Q Pro-community. Now let us see how they scored the economically friendly scenarios.

> Scenario 2 "economically sound, socially medium, ecologically poor" (A: 1.54, B: 0.32).
>
> Scenario 1 "economically sound, ecologically medium, socially poor" (A: 0.78, B: 0.81).

When the economic aspect was secured, Responsible Resource Use gave a higher priority to the social aspect than to the ecological aspect. Economic Scale did the opposite.

Thus, compared to Economic Scale, Responsible Resource Use was stronger in his economic interest. For them the economic interest was more important than the social interest when the ecological interest was not a question. The social aspect, in turn, was more important than the ecological aspect if the economic interest was not threatened. For Economic Scale the order was reversed. The social leaning does not seem to allow neglect of the ecological aspect.

e) Consensus

Besides all the differences between factors as described above, there were scenarios on which all the three factors had common views. They are presented in Table VI.4 along with the rank and z-score assigned by each factor.

Table VI.4: Rank and Score for Consensus Scenarios, Graphical Q Application

Factors	Conservative		Responsible Resource Use		Economic Scale	
	Rank	Score	Rank	Score	Rank	Score
Scenario 3	-1	-1.02	-1	-0.54	-1	-0.76
Scenario 4	1	0.36	0	-0.15	0	0.00
Scenario 8	-2	-1.21	-2	-1.60	-2	-1.53

Table VI.4 shows that all the three factors did not like Scenario 8, the "Business As Usual". This means the stakeholders did not like what was going on, especially as they saw the impacts depicted by the graphs.

The other two scenarios that gained consensus were both the socially friendly ones. Given the scores of –1 and 0, the social aspect seems to get less priority when stakeholders examine the land use scenarios and their impacts.

D. Two-factor Analysis

Evaluation of the characteristics of the factors shows that factor 2 and 3 shared interests in the economic aspect. A separate analysis of the sort data was done in PQM to further examine the relation between the two pro-economy factors. This time only two factors were selected for factor rotation, to see if there was an angle where factors 2 and 3 merged.

At the same confidence level of 95% as with the three factors presented above, 13 sorts had significant loading to one of the two factors. As expected, one factor was pro-conservation, and the other pro-economy. The factor loadings of all the 17 subjects when the significant loading threshold was lowered to 0.60 appear in Table VI.5.

Table VI.5 shows that all the sorts that loaded to the Conservative factor in the three-factor application above also loaded to the same factor here. There is one additional sort in this factor, i.e. sort 5 that previously loaded significantly to the Responsible Resource Use though also nearly equally strongly to the Conservative factor.

On the Pro-economy factor, there were four sorts that loaded significantly. Sort 3's loading was no longer significant. On the contrary, sort 9's loading to this factor was now significant. Sort 17, who was the most significant loading of Economic Scale, now loaded to the Pro-economy, but not significantly enough to be a defining sort. The insignificance of sorts 3 and 7's loadings to the Pro-economy factor was because the two sorts were extremely orthogonal. When the sorts were rotated around factors 2 and 3 as the axis, sort 17's loading to factor 3 increased and so did sort 3's loading to factor 2. When the sorts were rotated with the axis of factors 1 and 2, however, the two sorts were not positioned at the far ends of the axis, and consequently their loadings were low and insignificant.

Thus, the two pro-economy factors were of different characters. They received the pro-economy label for reference to different scenarios, which were both economic oriented but with different emphasis. This led this study to use the three-factor analysis rather than the two-factor analysis.

E. Scenario-Rank Analysis

Further to the information learned about factors' preferences, their consensuses, and disagreements, it would be useful to see how the scenarios fare in the overall ranking. In other words, which scenario is most popular and which is not acceptable? Such scenario ranking by the general stakeholders can be evaluated from different angles, as described below.

Table VI.5: Factor loadings of the graphical Q application (defining sorts in bold)

Sort Number	Pro-conservation	Pro-economy
1	0.23	**0.83**
2	**0.83**	0.37
3	-0.03	0.48
4	0.36	**0.69**
5	**0.63**	0.50
6	-0.43	0.29
7	**0.67**	-0.12
8	0.24	**0.88**
9	-0.04	**0.77**
10	**0.92**	0.08
11	**0.78**	-0.12
12	0.05	0.51
13	**0.81**	0.33
14	**0.83**	0.35
15	**0.88**	0.46
16	**0.81**	0.50
17	0.10	0.53

1. Scenario Ranking Derived from Graphical-Q Factors Sorts

The graphical-Q factor sorts contain z-scores, and ranks, that each factor assigns to each scenario. Such data allow evaluation of the popularity of each scenario through summation of scores or ranks assigned to each scenario. Table VI.6 presents the ranks given to each scenario by each factor, and Table VI.7 presents the z-scores for each scenario.

Tables VI.6 and VI.7 show among others that scenario 8 was the most unpopular scenario. It received the largest negative sum, as all factors ranked it last. This means that every factor did not approve the Business As Usual scenario. In other words, they wanted changes to the status quo.

On the other side, scenario 2 got the highest total score, especially as it was ranked the highest (2) by Responsible Resource Use. This may mean that this scenario was overall the most acceptable one. The next most acceptable scenarios were the two ecologically friendly scenarios 5 and 6.

Table VI.6: Derivation of Scenarios Ranking from Factor Sorts' Rank

Q Statement	Conservative	Responsible Resource Use	Economic Scale	Total	Rank
Scenario 1	-1	1	1	1	5
Scenario 2	1	2	0	3	1
Scenario 3	-1	-1	-1	-3	7
Scenario 4	0	0	0	0	6
Scenario 5	2	1	-1	2	2
Scenario 6	1	0	1	2	2
Scenario 7	0	-1	2	1	4
Scenario 8	-2	-2	-2	-6	8

Table VI.7: Derivation of Scenario Ranking from Factor Sorts' Z-scores

Q Statement	Conservative	Responsible Resource Use	Economic Scale	Total	Rank
Scenario 1	-0.97	0.79	0.78	0.6	6
Scenario 2	0.38	1.56	0.33	2.27	1
Scenario 3	-1.01	-0.56	-0.90	-2.47	7
Scenario 4	0.31	-0.10	0.42	0.63	4
Scenario 5	1.52	0.71	-0.62	1.61	3
Scenario 6	1.04	-0.04	0.69	1.69	2
Scenario 7	-0.08	-0.79	1.09	0.22	5
Scenario 8	-1.19	-1.58	-1.80	-4.57	8

2. Analysis of Individual Subjects' Sorts

As described in the section B.2 on procedure above, the sorts carried out by the subjects were rank ordered from 1 to 8, before later being structured into the 1-2-2-2-1 distribution. Such rank orders give an opportunity to treat the sorts as survey data to identify the most preferable scenario. The calculation can be done in different ways, depending on how the subjects are grouped.

a) Subjects grouped by verbal-Q factors

Table VI.8 presents a calculation of scenario preference by entering the sorts in groups of verbal Q factors. The table gives the overall rank order of the eight land use scenarios according to the survey that involved seventeen people. All the rank calculations involved averaging the score given to each scenario. Weighting the three verbal-Q factors equally (factor ranks) gave nearly the same rank order as weighting every subject equally (overall ranks).

The factor ranks in Table VI.8 shows slightly different ranks when the same vote was given to every factor in the survey. Ranks 1 to 4 remain the same, i.e. first the ecologically friendly then the economically friendly. Rank 5, however, was a spot for scenario 4 which was a socially friendly scenario.

The factor-based ranking from most to least liked is presented in Table VI.9. It shows that when the three verbal Q factors were equally weighted, the overall stakeholders' preference was first for the ecologically friendly scenarios (5 and 6). Their second preference was for economically friendly scenarios (1, 2 and 7). Their last preference was for socially friendly scenarios (3 and 4). Scenario 8, the business as usual, is an inferior scenario and was consistently disliked by all stakeholders.

b) Subjects grouped by graphical-Q factors

Scenario rank orders by the stakeholders can also be examined from the viewpoint of their groupings in the graphical-Q application. The calculation is presented in Table VI.10.

Table VI.10 shows that the overall rank order, which gives a vote to each subject, from the most to the least liked is scenarios 5, 6, 2, 4, 1, 7, 3, and 8. As compared to

Table VI.8, socially friendly scenario 4 slipped into the fourth slot. The two tables differ

Table VI.8: Calculation of Overall Ranks of Eight Berau District Land Use Scenarios by Verbal-Q Subjects Participating in the Graphical-Q Application

No.	Verbal Q Subjects	Graphical Q Scenario							
		.1	2	3	4	5	6	7	8
1	Pro-environment (4)	6	8	2	4	7	4	5	1
2	Pro-environment (59)	7	8	5	6	4	3	1	2
3	Pro-environment (16)	7	6	2	5	8	3	4	1
4	Pro-environment (41)	2	3	1	6	7	8	4	5
5	Pro-environment (42)	7	8	2	5	4	6	3	1
6	Pro-environment (43)	7	6	3	8	2	5	4	1
7	Pro-environment (56)	1	6	3	4	8	7	5	2
8	Pro-environment (37)	2	5	3	6	8	7	1	4
9	Pro-environment (53)	8	2	3	4	5	6	7	1
10	Pro-environment (10)	2	4	3	5	8	7	6	1
11	Pro-environment (47)	2	6	1	4	8	7	5	3
12	Pro-environment (63)	3	6	2	4	8	7	5	1
	Pro-environment Total	54	68	30	61	77	70	50	23
	Pro-environment Average	4.91	6.18	2.73	5.55	7.00	6.36	4.55	2.09
13	Pro-community (6)	3	5	2	7	6	8	4	1
14	Pro-community (62)	3	6	2	4	8	7	5	1
15	Pro-community (64)	5	7	2	4	3	6	8	1
	Pro-community Total	11	18	6	15	17	21	17	3
	Pro-community Average	3.76	6.00	2.00	5.00	5.67	7.00	5.67	1.00
16	Pro-business (34)	5	6	4	3	8	7	2	1
17	Pro-business (36)	8	5	1	2	3	4	7	6
	Pro-business Total	13	11	5	5	11	11	9	7
	Pro-business Average	6.5	5.5	2.5	2.5	5.5	5.5	4.5	3.5
	Overall total	78	97	41	81	105	102	76	33
	Overall average	4.59	5.71	2.41	4.76	6.18	6.00	4.47	1.94
	Overall ranks	3	4	7	5	1	2	6	8
	Factor average	4.99	5.71	2.32	4.23	5.81	6.08	4.75	2.14
	Factor ranks	4	3	7	6	2	1	5	8

in only one sort, i.e. number 36 of the verbal-Q application, which was not in Table VI.10. This one sort caused the shift of ranks.

The factor rank in Table VI.10 assigned a vote to each factor, and gave yet another order. Here the two ecologically friendly scenarios numbers 5 and 6 and the other two ecologically friendly scenarios numbers 1 and 2 remain at the top order. Their

ranks, however, juggle as compared to the orders in previous analyses. The order is now scenario 6 (ecological), 2 (economic), 5 (ecological), and 1 (economic).

Table VI.9: Survey Based Ranking of the Eight Land Use Scenario

Rank	Scenario	Label
1	5	"ecologically sound, economically medium, and socially poor"
2	6	"ecologically sound, socially medium, and economically poor"
3	1	"economically sound, socially medium, ecologically poor"
4	2	"economically sound, ecologically medium, socially poor"
5	7	"economically sound, ecologically medium, socially medium"
6	4	"socially sound, ecologically medium, economically poor"
7	3	"socially sound, economically medium, ecologically poor"
8	8	"economically medium, ecologically poor, socially poor"

The different rank orders of the scenarios occurred from analyses from different viewpoints. Each viewpoint has its own merits and flaws, which are discussed in the final chapter.

F. Conclusions

This chapter has presented the graphical Q application in the study. It shows how to understand stakeholders' preferences through the use of graphical information on land use scenarios, which is this study's last research question. As compared to the verbal Q application, in this graphical application the consequences were given more attention than they were in the verbal Q application. The latter did touch upon such scenario consequences as flooding, but the former much more fully cover it through the graphs of economic, ecological, and social consequences of the scenarios.

The Q sorting was apparently more difficult in this application than in the verbal Q application. This was due to either respondents' intellectual capability or their time available. The graphs in the Q cards were used to represent the reality of land use scenarios and their consequences. How simple the representation can go is a trade off between representativeness and meaningfulness.

Though limited by the lack of sorts because of the high intellectual requirement on the respondents, the results gave some methodological insights into stakeholders' opinion on

land use planning. These include the groupings among them along with their likes and dislikes. Also obtained was some information on similarities and differences between groups of thought.

Table VI.10: Calculation of overall ranks of eight Berau District land use scenarios by graphical-Q subjects

No.	Verbal Q Subjects	Graphical Q Scenario							
		1	2	3	4	5	6	7	8
1	Pro-environment (6)	3	5	2	7	6	8	4	1
2	Pro-environment (41)	2	3	1	6	7	8	4	5
3	Pro-environment (56)	1	6	3	4	8	7	5	2
4	Pro-environment (37)	2	5	3	6	8	7	1	4
5	Pro-environment (10)	2	4	3	5	8	7	6	1
6	Pro-environment (47)	2	6	1	4	8	7	5	3
7	Pro-environment (62)	3	6	2	4	8	7	5	1
8	Pro-environment (63)	3	6	2	4	8	7	5	1
	Total Pro-environment	18	41	17	40	61	58	35	18
	Average Pro-envmt	2.25	5.12	2.12	5	7.62	7.25	4.37	2.25
9	Responsible Res. Use (4)	6	8	2	4	7	4	5	1
10	Responsible Res. Use (59)	7	8	5	6	4	3	1	2
11	Responsible Res. Use (16)	7	6	2	5	8	3	4	1
12	Responsible Res. Use (34)	5	6	4	3	8	7	2	1
13	Responsible Res. Use (42)	7	8	2	5	4	6	3	1
	Total Responsible Res. Use	32	36	15	23	31	23	15	6
	Average Res. Resource Use	6.4	7.2	3	4.6	6.2	4.6	3	1.2
14	Economic Scale (43)	7	6	3	8	2	5	4	1
15	Economic Scale (53)	8	2	3	4	5	6	7	1
16	Economic Scale (64)	5	7	2	4	3	6	8	1
	Total Economic Scale	20	15	8	16	10	17	19	3
	Average Economic Scale	6.67	5.00	2.67	5.33	3.33	5.67	6.33	1.00
	Overall Total	70.00	92	40	79	102	98	69	27
	Overall Average	4.12	5.41	2.35	4.65	6.00	5.76	4.06	1.59
	Overall Ranks	5	3	7	4	1	2	6	8
	Factor average	5.11	5.78	2.60	4.98	5.72	5.84	4.57	1.48
	Factor Rank	4	2	7	5	3	1	6	8

Two poles of interest appeared from the analysis, i.e. the Conservative and the Economist. Analyses of the Q sorts as 'survey' data gave different rank orders of scenario likableness when seen from different angles. The merits and flaws of the

different analyses are discussed in Chapter VIII. The above information is systematically organised in Figure VI.3.

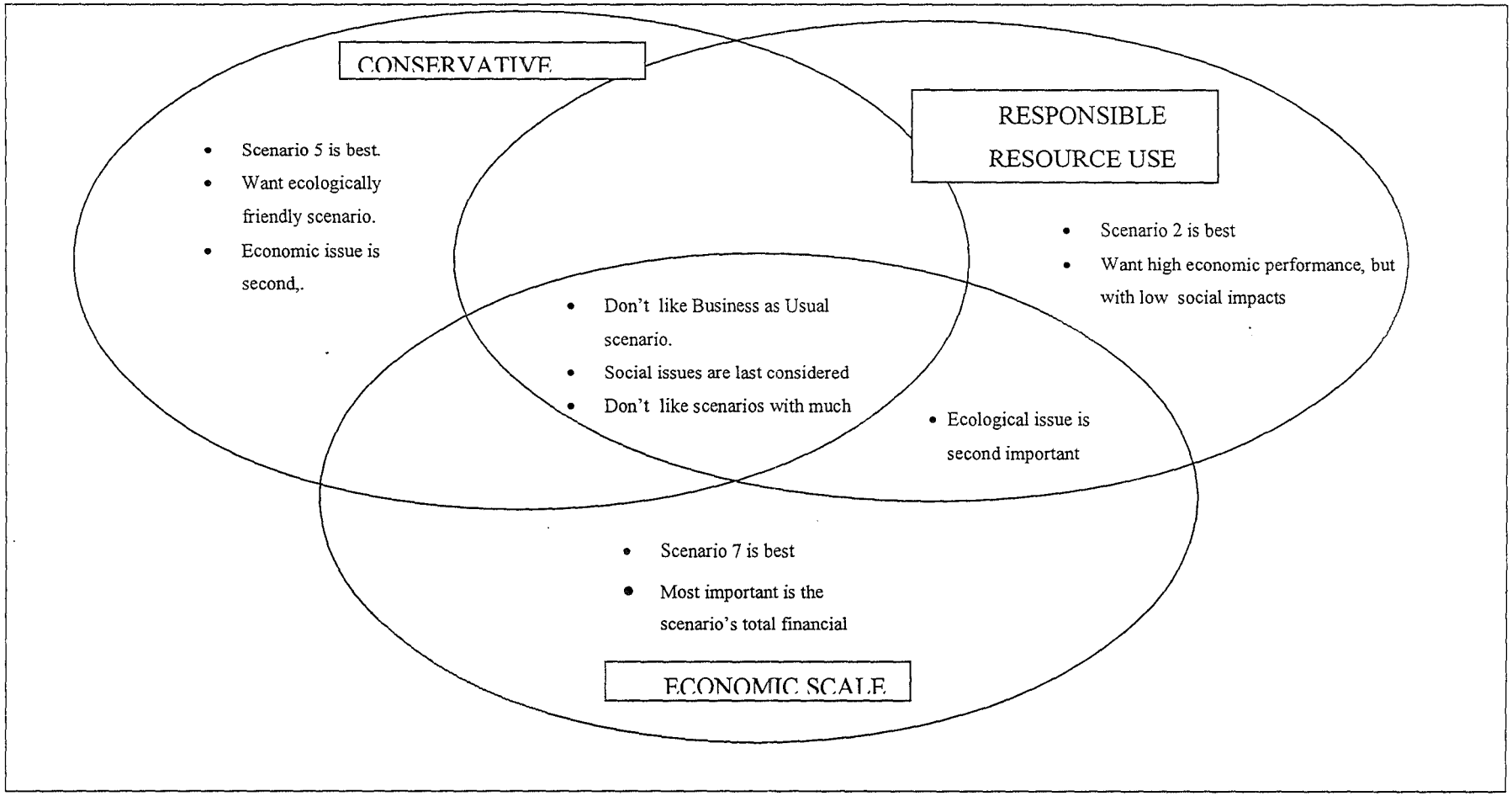

Figure VI.3: Joint and Contrasting Views Between Graphical Q Factor

CHAPTER VII
BETWEEN VERBAL AND GRAPHICAL Q APPLICATIONS

A. Introduction

This chapter presents a comparison between the verbal Q application presented in Chapter V and the graphical Q application presented in Chapter VI. The two applications are suitable for comparison especially because they were conducted in the same Case Study, and both referred to the same respondents.

This comparison covers the technical-procedural aspect and the results. The technical and procedural contrast focused on the demands on respondents in producing their sort. The difference in results was seen in terms of respondents' consistency in expressing their views through the two kinds of Q applications, and the factors that emerged from analysis of the sorts.

B. Demand on Respondents

Verbal Q Application. Q-methodology is usually applied with verbal Q statements such as in the application reported in Chapter V. Commonly the application involves sorting between 30 and 60 Q cards (Brown 1986; Fairweather and Swaffield 1994; Addams 2000), and this puts some demands on the respondents. Firstly, the respondents must be literate, and secondly, the respondents must be intellectually capable of rank-ordering so many statements. This may not be a problem in developed countries, but could be so in a developing country like Indonesia.

In the trial phase of the verbal Q application, 33 cards were used. The feedback from the respondents was that they were too numerous. It was then decided to reduce the number to 22. This size of card deck could be sorted by community leaders in the rural areas of Kalimantan.

Graphical Q Application. In graphical Q applications, the number of cards would be substantially smaller than in verbal Q applications. This is because the subjects would not be able to comprehend and compare the graphs if there were many of them. In this Case Study, there were only eight graphical Q cards. Yet they appeared to

be many, because in each of them there were eight graphs on each card. Indeed, it was the card content, rather than the card number, that was very demanding on the respondents. While they were carefully selected from a wide range of information available from the model runs, their combination was still challenging. Many respondents of the verbal Q application were discouraged from doing the graphical Q sorting. The reasons were twofold. One was the intellectual capability required, and the other was the increased time needed to complete the sorting. Out of the 67 respondents of the verbal Q application, only 17 did the graphical Q sorting, all of whom were university graduates. This was a disadvantage in that the community leaders were not represented in the 17 respondents.

The land use planning information produced through the FOLPI modelling exercise was meant to respond to the need of a multi-stakeholder team contemplating a national forest land use plan. The members were relatively highly intellectual, who wanted to see the impacts of land use scenarios in quantitative measures. They spent many hours in a long series of meetings, and would have been more than happy to sit together and study all the graphs. It was hard to obtain such a commitment in the interview situation as in this study. That only 17 out of the 67 verbal Q respondents undertook the graphical Q sorting can therefore be understood.

C. Factors

While the verbal Q application gave three factors, the graphical Q application essentially had only two factors, the Pro-conservation and the Pro-economy. The Pro-community factor that surfaced in the verbal Q application did not appear in the graphical Q application.

Two explanations are offered for this phenomenon. The first possibility was that there are actually only two types of stakeholders out there. This was indicated by Coke and Brown (1976), who categorised opinions on land use into developmentalist, environmentalist, and cooperative, but where the last category was between the other two major factors. The verbal Q Pro-community indeed had split opinions between the other two. They liked most of the ecologically friendly ideas of the Conservative, and yet they would like to have the natural resources used, presumably by them. For example, they did approve the idea of leaving much forest intact.

The other possibility was that the Pro-community factor existed, and the graphical Q application failed to capture it. This may have happened because of the absence of respondents from among the community leaders, who were unsuited to the nature of the complicated graphical Q cards. It should be noted, however, that there were three verbal Q Pro-community among the graphical Q respondents, who were not enough to give a factor.

Another possible cause of the failure to capture the Pro-community factor is the subtlety of the social aspect, which made it more difficult to describe in graphs. As noted in section C above, a low labour requirement can mean a good thing for one person and a bad thing for another. Also, a great magnitude of shifting cultivation may be considered good by a person because it provides a source of living for local people, but it may be bad for another person because of the environmental consequences. This indicates that the indicators of social consequences could be inappropriate. Employment and shifting cultivation might not be the appropriate indicators, though they were identified from the interviews with stakeholders. Other indicators might have been better, such as local employment and provision of public services such as in education and health. The challenge, however, would have been in getting the data that link these indicators with the land use planning scenarios.

D. Consistency of Respondents

As the 17 respondents doing the graphical Q sorts were part of the 67 respondents in the verbal Q application, it would be interesting to see how the 17 respondents affiliated themselves to the factors in the two separate applications.

Tables VII.1 and VII.2 and Figures VII.1 and VII.2 show consistency and inconsistency. On the consistency side, all eight respondents affiliated with the Conservative factor of the graphical Q application are affiliated with either the Pro-environment Factor (6 respondents) or the Pro-community Factor (2 respondents). Also, the two Pro-business from the verbal Q application who took part in the graphical Q application both affiliated themselves also as Economists. This is consistent with information from Table 6.8 in the previous chapter. For convenience, the sums and averages in that table are presented in Table VII.3.

Table VII.1: Association of Qualitative and Quantitative Factors

No.	Background	Verbal Q Factor	Graphical Q Factor
4	Lecturer	1	2
6	Forestry state company	2	1
10	Private company	1	1
16	District govt	1	2
34	Forestry state company	3	2
36	Private company	3	(3)
37	NGO	1	1
41	Coal company, forester	1	1
42	District govt company	1	2
43	Lecturer, forestry	1	3
47	NGO	1	1
53	NGO (ex Govt.)	1	3
56	Forestry central govt.	1	1
59	Forestry central govt.	1	2
62	Private company	2	1
63	NGO	1	1
64	University	2	3
		Notes: 1: Pro-environment 2. Pro-community 3 Pro-business	Notes: 1. Conservative 2. Responsible Res. Use 3. Economic Scale

Table VII.3 shows that the verbal-Q Pro-environment consistently ranked the two ecologically friendly Scenarios 5 and 6 as the top two. The verbal-Q Pro-businesss were also consistent, ranking two economically friendly Scenarios 1 and 2 as the top two.

The Pro-community factor is where inconsistency lies. As can be observed in Table VII.3, rather than ranking high with the two socially friendly Scenarios 3 and 4, they attached ranks 7 and 5 respectively to them. As their first and second ranks, their choices were respectively the ecologically friendly Scenario 6 and economically friendly Scenario 2. This fact again underlines the underlying problem with the social aspect representation in this Q application.

Table VII.2: Rearranged Association of Qualitative and Quantitative Factors

Graphical Q	Verbal Q	Note
8 type 1 (Conservative)	6 type 1 (Pro-environment)	3 NGO 1 Government 2 Private company
	2 type 2 (Pro-community)	1 State company 1 Private company
5 type 2 (Responsible Res. Use)	1 type 3 (Pro-business)	1 Private company
	4 type 1 (Pro-environment)	1 Lecturer, production 1 Govt. planner 1 State company 1 Govt., central
4 type 3 (Economic Scale)	1 type 3 (Pro-business)	1 Private company
	2 type 1 (Pro-environment)	1 lecturer 1 NGO, ex govt.
	1 type 2 (Pro-community)	Lecturer

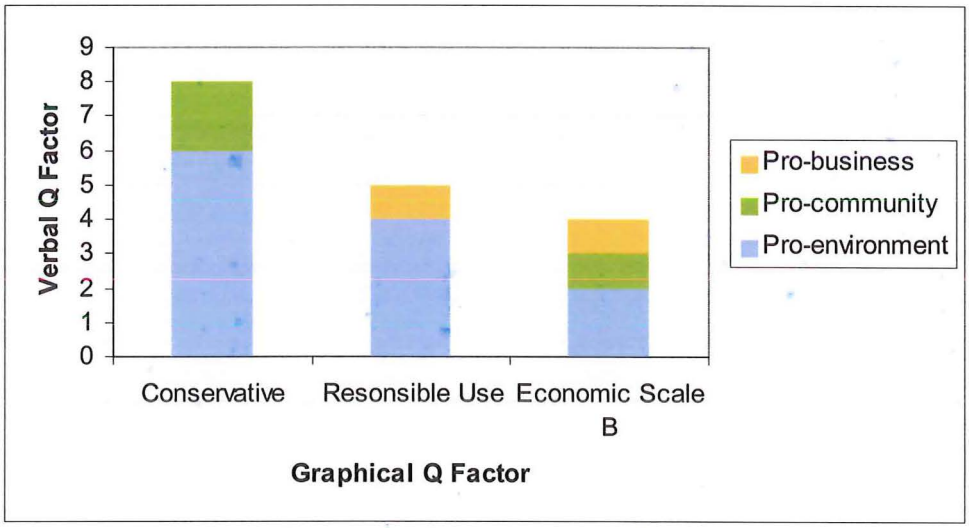

Figure VII.1: Association of Graphical and Verbal Q Factors

Another inconsistency surfaces with six Pro-environments and one Pro-community from the verbal Q application identifying themselves as pro-economy (Responsible Resource Use and Economic Scale) in the graphical Q application. Of the

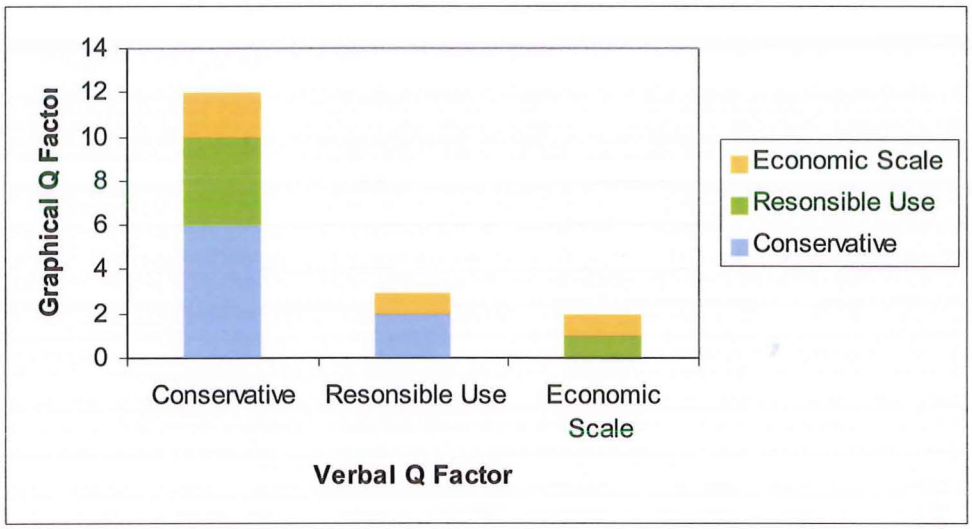

Figure VII.2: Association of Verbal and Graphical Q Factors

seven of them, one was from a state company, three were lecturers, two had a government background, and one was from an NGO. A possible reason for the inconsistency is that they actually had some leaning towards the economic aspect. This is examined through observation of their loading to the economic factor in the verbal Q application, as presented in Table VII.4.

The above loadings to the Verbal Q Pro-business Factor do not reflect even just moderate leaning towards the economic aspect. Only sorts numbers 4, 42, and 59 had moderate affiliation with the Pro-business. The rest were not affiliated or even negatively affiliated.

Under such inconsistent loading, it would be interesting to look at the arguments behind the sort. An example is graphical Q sort number 4, who was a government officer and also active in the NGO circle.

> Scenario 5 most agreed with: conservation forest is left intact; labour requirement increases but gradually, not causing social impacts such as crimes - because our population is small, we would have to take labour from outside the district if requirement was high; shifting cultivation is low; carbon stock is good;
>
> Scenario 1 second: low level of shifting cultivation; labour requirement not abrupt increase;
>
> Scenario 2 third: same reasons as scenario 1; plus the forestry levies increase, which is appealing.

Table VII.3: Ranks of Eight Berau District Land Use Scenarios by Verbal-Q Subjects Participating in the Graphical-Q Application

Verbal Q Subjects	Graphical Q Scenario							
	1	2	3	4	5	6	7	8
Pro-environment Total	54	68	30	61	77	70	50	23
Pro-environment Average	4.91	6.18	2.73	5.55	7.00	6.36	4.55	2.09
Pro-environment Rank	5	3	7	4	1	2	6	8
Pro-community Total	11	18	6	15	17	21	17	3
Pro-community Average	3.76	6.00	2.00	5.00	5.67	7.00	5.67	1.00
Pro-community Rank	6	2	7	5	3	1	4	8
Pro-business Total	13	11	5	5	11	11	9	7
Pro-business Average	6.5	5.5	2.5	2.5	5.5	5.5	4.5	3.5
Pro-business Rank	1	2	7	8	3	4	5	6
Overall total	78	97	41	81	105	102	76	33
Overall average	4.59	5.71	2.41	4.76	6.18	6.00	4.47	1.94
Overall ranks	3	4	7	5	1	2	6	8
Factor average	4.99	5.71	2.32	4.23	5.81	6.08	4.75	2.14
Factor ranks	4	3	7	6	2	1	5	8

Table VII.4: Loadings to Verbal Q Factors of some Graphical Q Economists

Sort No.	Pro-environment	Pro-community	Pro-business
4	0.65	0.39	0.43
16	0.68	0.54	-0.18
42	0.671	0.39	0.32
43	0.70	0.37	0.11
59	0.62	0.47	0.28
53	0.67	0.59	0.03
64	0.42	0.77	-0.02

He gave high scores for Scenarios 1 and 2 not for the economic reasons but for the low social risk related to the low rate of shifting cultivation and the low requirement for labour. This indicates that the social impacts were relatively more difficult to describe in graphs, as the interpretation was various. Low requirement of labour, for example, could be a good thing for one person but bad for another person. So was the magnitude of shifting cultivation.

Let us examine another sort, number 62. As quoted in Chapter VI, on the characteristics of the Economic Scale factor:

> "I like scenario 7 especially because the sum of financial resources is high. Then the biodiversity index if it does not increases then it flattens. Soil damage decreases. Carbon stock increases. Job opportunities are quite high."

Apparently he picked the economically friendly Scenario 7 for the truly economic reason. However, in the verbal Q application, he loaded heavily to the Pro-community and Pro-environment. This may indicate that graphs may change someone's opinion and preference. More factual information may provide more insights and affect decision making.

E. Normative and Positive Information:

The information resulting from the verbal-Q application and that from graphical-Q application in this study are different. The former is normative and the latter is positive. Here normative statements refer to "how things should be or ought to be". Positive statements, on the contrary, are objective descriptions that are falsifiable[10].

The verbal-Q resulted in information on factors' likes and dislikes of land use scenarios as described by the bias, wish, and policy statements (see Section V.B.2.b). For example, stakeholders of one factor may like to see "much forest left intact" and those of another factor may not. One would not be able to positively suggest how many hectares 'much forest' refers to.

The graphical-Q resulted in information that was more positive. For example, an analysis determined that Scenario 5 is the most popular. This means that the majority of stakeholders prefer the land use scenario to be ecologically sound, economically

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[10] E-paranoids. http://www.e-paranoids.com/p/po/positive_sciences_.html. Visited 30/1/2005

medium, and socially poor. While this is still somewhat normative, the graphical scenario also gave positive representation of the norms in the form of graphs.

Both normative information and positive information are useful. In the beginning of the planning process, it might be good to start with a normative basis such as which norms the stakeholders would be in consensus with, and which they would disagree with. From there one can move into more specific planning and incorporate the more positive information that was produced in the graphical-Q application.

F. Conclusion

Verbal Q application is different from graphical Q application in a few aspects. First, in terms of the difficulty for respondents to do the sorts, the verbal Q application had an advantage. The requirements on respondents were merely literacy and some intellectual capability. The graphical Q sorting put a greater demand on the respondents. The literacy requirement may be irrelevant, but the high level of intellectual capability required to sort the graphical cards may mean that an illiterate person would not be able to do it.

The second difference related to the factors. In the two types of Q application, the same group of respondents attached themselves to different numbers of factors. Both applications had the factors that supported the ecological aspect and economic aspect, but only the verbal Q application had the factor that was pro-community. This could be because the graphical Q application failed to capture the pro-community's existence, or because such factor simply did not exist and it was merely a variant of the Conservative.

CHAPTER VIII
DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

A. Introduction

This chapter draws key points from the results presented in Chapters IV to VII. They are summarised and argued to render them meaningful in the whole context of this study and are presented in the order that they appear chapter by chapter. The arguments are summarised at the end of the chapter in the form of a list of conclusions. This thesis ends with some recommendations, which are meant as the answers to the research questions, and by so doing, as the response to the stated aim of the study.

B. Scenario Modelling

There are three issues that need emphasising for the scenario modelling. First is the innovation of the factorial design with various levels of emphasis on the economic, ecological and social aspects. The second is regarding the data for scenario modelling, especially for future application in different areas in Indonesia. The last one is on the prospect of using FOLPI.

1. Scenario Identification

The scenarios identified for the case study were derived from input from the stakeholders. Examination of stakeholders' wish lists (derived from interviews with 49 people from November 2001 – May 2002) showed that they were concerned, though at different levels, with economic, ecological and social aspects. This finding inspired the development of a factorial design (see Table 4.1) which identified six scenarios with different emphasis on the three aspects, i.e. one sound, one medium, one poor. In addition to the six, two other scenario were identified, i.e. the Business As Usual and the District Government Plan. This scenario development process conforms with Dijk's (2003) note that scenario generation depends on creativity and inputs from different sources (see Section III.D.4).

The factorial design was very practical. It resulted in just six cells, which after the inclusion of local scenarios became eight. This was small enough to be not too complicated for sorting, and yet suitable for Q analysis. In addition, despite the small number, the scenarios could cover a comprehensive range of land use issues.

2. Data for Scenario Modelling

In order to model the scenarios and their impacts, data were required for each land use or sub-land-uses in terms of their area and resources involved in their activities, to be available year by year. The resources were classified into yield, economic resources (cost, revenues), ecological resources (biodiversity, soil, carbon), and social resources (labour). Much of the data for Berau District were available from BFMP. They were in the form of land maps and the resources involved in the operational activities of natural forests, plantation forests, and oilpalm plantations.

Such data as BFMP's may not be available in many other areas in Indonesia, because technical data is generally a luxury in developing countries. As Tyrie (1999: 1) notes, Berau had "an unparalleled data set of environmental, inventory and regrowth information..." However, some of the Berau data can be applied in other areas, though some correction or calibration may be necessary. With some other data, collection of additional data may be necessary. It is a matter of collecting the best available and collectable data which are meaningful and acceptable to the stakeholders.

3. FOLPI Simulation

FOLPI proved to be suitable for modelling land use changes and their impacts. While originally it was used for forest management purposes, and as an optimiser, FOLPI is capable of taking up the task of simulating the dynamics of scenarios that cover a wide range of land uses. Just like a type of forest, the different land uses can be included in the model as long as the required data are provided. It was assumed that the scenarios being evaluated were financially feasible, which actually needs to also be consider but lies beyond the scope of this study.

The summary reports that FOLPI produces are very convenient data sources. The area dynamics of each land use are reported, as well as the resources involved in the process. The resources reported include those that can occur any year during the planning period, those removed by harvest, or left after harvest. These are a very rich source of data for producing graphs on the land use changes and their impacts. Such

graphs were required by the Indonesia planners, who were trying to prepare development of a National Forest Programme. Indeed this is step 6 in the FAO Guidelines for Land Use Planning. This step is one of the most technical ones in which stakeholders in developing countries need support.

C. Q Application in Indonesia

1. Q's Potential Uses

The Indonesian forestry and forestry-based land use situation exemplified the contentious subject matter of land uses as described by Coke and Brown (1976) that land is a concept most affiliated with property, and that attitudes towards property have been affiliated with conflicts. FAO (1993) also started its Land Use Planning Guidelines with a similar recognition: "There is bound to be conflict over land use."

Forest lands have different benefits, and people have different attitudes towards the benefits. The benefits can be put into economic, ecological and social categories. People have different interests in those uses, and the differences have caused many conflicts. Such conflicts have eventually harmed the resources and need to be reconciled before the resources go beyond recovery. The Government has the authority and responsibility to do the job, but experience in Indonesia shows that alone it can not do a great job of developing a sound and acceptable land use planning. It needs the support of all stakeholders. This is in line with Lin's (1998) note, as quoted in the introductory chapter, that the implementation of any policy requires support and cooperation of stakeholders.

Q-methodology, as exemplified by its applications in the case study, offers the potential to help resolve the conflicts surrounding forest land uses. In fact, its potential in Indonesia is not restricted to the field of land use planning. The methodology can uncover the groupings of opinion among the stakeholders. It can also describe the characteristics of each grouping, and the similarities and dissimilarities between the groupings. Such information would offer a lot to the conflict resolution process. The good prospects of such an application are seen from the initial interest of the respondents in using the methodology, and supported by the availability of the analysis software free of charge on the internet.

2. Q Application in Developing Countries

Q methodology was born in the U.K. and grew largely in the U.S. Most applications so far have been in developed countries, where citizens are most likely to be literate and relatively well educated. They normally have no difficulty doing the Q sorts, which usually involve about 30 statements.

The situation in developing countries like Indonesia is different, especially in the rural areas. The literacy rate is lower, and many people are educated at a lower level, if at all. In this study, the issue of education background was the basis to reduce the number of Q statements from 33 to 22. Q samples were originally 33 in number. The trial interviews In the verbal Q application suggested that the originally 33 statements were too numerous if they were to be taken to the rural areas of East Kalimantan. Consequently the sample number was reduced to 22, and the field interviews ran quite well. Sixty-seven subjects did the sorts with little difficulty.

The graphical Q application in the case study provided quite a different experience. While the number of items to be sorted was only eight, their contents were much more complicated with each card having eight graphs and one verbal box. Of the 67 subjects doing the verbal Q sorts, only 17 finally did the graphical Q sorts. They were university graduates. This was clearly due to the required understanding of the complicated graphs. However, it should be noted that there are such stakeholders with high intellectuality and readiness to perform the complicated Q sorting. Members of the NFP Task Force as described in Chapter II were among them.

3. Technical Aspect for Application

The wide application of Q methodology in such developing countries as Indonesia in the future will be facilitated by ease of use. While it is true that Q methodology involves the complicated statistical method of factor analysis, computer software now assists this part of the work. The good news is that such software is also available free on the internet, which is very helpful for interested people in the developing countries. In order to apply the Q methodology, one merely needs to learn the basic principles involved and download software like the PQM from the internet free of charge. There is no need to learn in depth the complicated factor analysis. Brown (1993) likens it to driving a car, where the driver only needs to know the principles such

as when to refill the petrol and change the oil, without having to master the complexity of the engine.

Such a prospect of implementation in Indonesia was indicated by the interests of the subjects interviewed during the applications in the case study. Several of them were involved in social research or conflict resolution exercises. They were interested in the approach offered by Q methodology, i.e. having subjects sorting a set of cards then finding patterns in the correlations between subjects. They were particularly encouraged when learning that the analysis is facilitated by free software, though its use would require some training on the methodology, especially in interpreting the results produced by the software.

D. Verbal Q Application

There were interesting findings in the verbal Q application. These include what types of stakeholders exist, and how they think about resource use issues.

1. Factors and membership

There were three factors or types of stakeholders in the verbal Q application, i.e. the Pro-environment, Pro-community, and Pro-business. The membership showed some consistency, e.g. most NGO subjects affiliated themselves with the Pro-environment, community leaders with the Pro-community, and company people with the Pro-business. Government officers split into Pro-environment and Pro-community. What looks like inconsistency is that seven company people affiliated themselves with the Pro-environment, but this may be attributed to their personal or historical background.

Moreover, Q methodology is primarily meant to reveal the typology of subjects existing in the population. The membership of each type may be useful information, but for certainty such information can always be rechecked through a survey. Such a survey may bring the resulting list of characteristics of each factor and ask a random sample of the population to affiliate themselves with the lists.

2. Factor characteristics, consensus, and disagreement.

The factor sort and distinguishing statements show that Pro-environments would like to see ecological impacts of the land use scenario minimised by enforcement of the Environmental Impact Assessment. That would also ensure that plantations be

established on non-forested lands, so that much virgin forest can be left intact for non-timber uses such as medicinal plants, flood avoidance, and non-timber financial income for the local people. This factor disagreed with overuse of the natural resources.

The Pro-community would like to see local people prosper from proper use of natural resources, be it through modern utilization, employment by companies, or an improved profit sharing system. Like the Pro-environment, they also disagreed with over use of the natural resources. On leaving much forest intact, however, they share ideas with the Pro-business and against the Pro-environments. What made them different from the rest was their acceptance of land titles for shifting cultivation lands.

The Pro-business would like to see natural resource utilisation run well as that would bring benefits to local people and the Government, besides the company. For that reason they would like to have the support of the Government, such as through provision of social stability. They did not like the idea of leaving much forest intact, but that does not mean that they approve of over use of natural resources.

In addition to giving the distinguishing characteristics between factors, Q analysis also gives information on consensus and disagreement between factors. The three factors shared the views that companies should have effective community development programmes, that high erosion risk must be minimised, and that natural resource exploitation should be in moderation. Among the most severe disagreement was the refusal by Pro-environments and Pro-communitys of the Pro-businesss' views that the Government should prevent local communities claim rights against companies and give more incentives to natural resource utilisation businesses, and that big business would always bring prosperity to the local people.

3. Factor's Preferred Scenario Elements

The above information gave some leads to the factors' preferred land use scenario elements. The Pro-environments, for example would prefer a scenario that involves little harm to ecologically valuable resources such as virgin forests. This means no virgin forest conversion into forest plantations and agricultural plantations. Rather, those plantations have to be established on grassland or poor secondary forests. Protection and conservation forests would be left intact, as they prevent erosion and flooding and store non-wood forest products. Mining intensity would also be reduced under their scenario.

The Pro-community would like to see land uses that benefit the local communities. Local employment would be welcome, which may involve labour intensive activities such as oilpalm plantation. Shifting cultivation, especially in a sustainable form, would also be accepted under their scenario. For the sake of local people's prosperity, they would agree on clearing some forests.

The Pro-business would prefer a scenario that involves much economic activity. Their scenario would welcome a high rate of agricultural plantation and forest plantation establishment, as well as mineral mining. Forests would be exploited to a relatively high extent.

Along with the consensus and disagreed elements of land use planning, these pieces of normative information provide understanding of stakeholders' opinions about land use planning elements. They can be used in tandem with positive information from the graphical Q application to develop an acceptable land use scenario.

E. Graphical Q Application

Information of a similar structure as in the verbal Q application was generated during the graphical Q application. The difference is that the information here is more positive, rather than being normative.

1. Factors and membership

There were three factors or types of stakeholders, i.e. Conservative, Responsible Resource Use and Economic Scale. Economic Scale emphasised economic scale regardless the consequences, while Responsible Resource Use was concerned about consequences. Unlike in the verbal Q application presented in Chapter V, the social interest did not appear in this application. The social aspect lacked weight in the stakeholders' eyes during the Q application. This maybe because the social factor is more subtle and more difficult to present in graphs. Another possible cause was the lack of subjects with social backgrounds.

Of the 16 subjects significantly loading to one of the factors, 8 loaded to the Conservative, and the other 8 to the Economists (5 to Responsible Resource Use and 3 to Economic Scale). In terms of the professional backgrounds, similar affiliation occurred to that in the verbal Q application. NGO subjects mostly adhered to the Conservative, Government subjects splits, and again, some private company subjects affiliated

themselves with the Pro-environment. In terms of their label in the verbal Q application (see Table 7.2), 10 subjects consistently affiliated themselves to the corresponding factors in both Q applications, while 7 verbal Q Pro-environment/Pro-community affiliated themselves to either Responsible Resource Use or Economic Scale. There are two possible reasons for this. Firstly, the subjects shifted their ideas as they saw different presentations of the elements of land use scenarios. Secondly, the subjects picked the scenarios for different interpretations of the graphs. This means that the intended message in the social aspect graphs may not go with stakeholders' perceptions. For example, while the verbal Q Pro-community approved shifting cultivation, when presented in graphs the idea was rejected.

2. Factor characteristics, consensus, and disagreement

The factor sort shows that the Conservative preferred ecologically friendly scenarios the most. The next preference was for economically friendly scenarios, and the last preference was for socially friendly scenarios.

Responsible Resource Use prioritised the two economically friendly scenarios. Their next priority was for ecologically friendly scenarios and of least priority was the socially friendly scenarios. Responsible Resource Use was similar to Economic Scale, but the latter gave high value to the District Government's scenario. This means they emphasised the financial magnitude, while Responsible Resource Use also cared for the potential negative social impacts of such great magnitude.

Despite the differences, the three factors held a consensus to refuse the Business As Usual scenario, which was indeed inferior, as well as the two socially friendly scenarios.

3. Preferred Scenarios

Voting approach. One way to identify the preferred scenario is by evaluation of the votes achieved. There were different approaches to determining who received a vote, i.e. a subject or a group of them. The results of such voting allocation variations are summarised in Table 8.1.

These different approaches and results showed that the stakeholders' preference in terms of the scenario ranks depends on the calculation approach. Different approaches give different weights to stakeholders. They can be assigned a vote each, or their group can be assigned a vote each. There are different ways to group stakeholders, whether

according to their affiliation to the verbal Q application or to the graphical Q application. The value of each vote also differs. A vote can be in the form of a factor z-score from a quasi normal distribution. It can be the z-score's rounding into a factor rank, or alternatively it can be a figure from 1 to 8.

Table VIII.1: Different Approaches To Find Composite Ranking Of Scenarios

No	Subject	Score	Resulting Ranking							
1	Graphical Q factors	Sort z-scores	2	6	5	4	7	1	3	8
2	Graphical Q factors	Sort ranks –2 to 2	2	5	6	7	1	4	3	8
3	Graphical Q factors	1 through 8	6	2	5	1	4	7	3	8
4	Graphical Q, 17 individuals	1 through 8	5	6	1	2	4	7	3	8
5	Graphical Q, 16 significantly loading individuals	1 through 8	5	6	2	4	1	7	3	8
6	Verbal Q factors	1 through 8	6	5	2	1	7	4	3	8

The different ways of calculation gave different resulting ranking, but it could be seen through Table 8.1 that scenarios 5, 6, and 2 were most liked and that scenarios 8 and 3 were most disliked. These preferred scenarios could be selected for use in the consultation with the broader stakeholders. With the scenarios selected, the next issue is determining the portion of the population preferring each scenario. This is "a matter of nose-counting best left to surveys" (Brown 1993: 120), while the graphical Q application provides the question to ask. The subjects are asked to choose their favourite scenario among the three. With the sample only consisting of three cards, the stakeholder population may now be broader.

This is an example of combination between qualitative and quantitative approaches. The quantitative survey would help evaluate the hypothesis and see whether it is correct (Lin 1998), while Q help finding the right questions and give additional confidence in the conclusions. Without the right questions to ask, according to the postpositivists the conclusion is likened to "a mindless multiplication of superficially similar facts, which do not explain anything" (Lin 1998: 172).

Minimised rejection. The other way to identify the preferable scenario is by seeing which one would gain the greatest consensus acceptance, or at least get the least rejection by factors. This refers to observation of Table 6.6 in Chapter VI. The table shows that Scenario 6, which, according to the voting approach, was preferred by the majority was not rejected by any factor. However, its acceptance was not strong either, gaining score 1 from the Conservative and the Economic Scale. Meanwhile, Scenario 2 gained more enthusiastic acceptance, with Economic Scale scoring 2, Conservative scoring 1, and Economic Scale scoring 0. While in a democratic system Scenario 6 would be the winning scenario, it could be expected that Scenario 2 would be more easily accepted in the consultation process. This is especially true if the scenario that won in the vote averaging had a negative score, which means some rejection by some stakeholders.

This method of identifying an acceptable scenario could be checked using a survey. In this case, as the identified scenarios with least rejection were the same as those identified by way of voting, the same survey described above would provide the answer. Otherwise, the additional scenarios would need to be included in the survey.

F. Between Verbal and Graphical Q Applications

The two different approaches to the Q application in the study has generated useful lessons, especially for further nurture of the unconventional graphical Q approach. These include the technical difficulties, the results, and the use of the results.

1. Sorting difficulty

In the graphical Q application, each of the eight graphical Q cards contained eight graphs and one verbal description box. Some graphs presented considerable information and proved to be quite complicated. Of the 67 respondents doing the verbal Q sorts, about 25 were approached to do the graphical Q sorting, considering either their intellectual capability or their time availability. And finally 17 of the 25 approached did the sorts. The level of complication of the sorting could have caused the low level of response. That level of complication can indeed be adjusted, as the graphs are models of the land use plans and their consequences. Such reality is extremely complex and the models try to represent them in more simple ways. How simple they can go is a matter of trade off between the level of reality to be presented and the comprehensibility of the

information presented. Further studies may benefit from exploring possibilities for simplifying the graph presentation while still representing the land use plan adequately.

The experience from the graphical Q application indicates that the level of the level of difficulty as applied had limited the number of subjects who did the sorting. In the case of successful sortings, intensive clarification during the sorting was necessary.

2. Factors and Consistency Across Q Sorts

As mentioned in section VII.D, there were differences between the two Q applications in terms of the factors. The verbal Q application identified the Pro-environment, Pro-community, and Pro-business, while the graphical Q application identified the Conservative, Responsible Resource Use, and Economic Scale. The absence of the Pro-community in the graphical Q application calls for the need for further studies or applications to include stakeholders with social background and high intellectual capability. Also, more indicators should be included that better represent the social aspect of scenario consequences, such as local employment, and public services.

As the subjects of the graphical Q application also participated in the verbal Q application, their affiliation to the factors in the two applications can be observed. There were both consistency and inconsistency in their affiliations. The inconsistency needs closer examination.

3. Using Normative and Positive Information

The two Q applications in this study produced different types of information. The verbal Q application gave more normative information on stakeholders' preference on land use planning. The graphical Q application gave more positive information in the form of preferences on a graphically presented scenario.

These two types of information can support each other. The normative information on the characteristics of stakeholder types can help with the communication among them, which can be facilitated by a neutral person. As Steelman and Maguire (1999: p.117) noted, "preparation of a facilitator to foster focus group policy dialogue is made much easier by educating him or her in advance on the perspectives revealed by the common Q factors." A similar view is offered by Barry and Proops (1999), who maintained that understanding people's discourse is key to judging if a policy will be socially acceptable.

In practice, the communication can start with consensus issues, and slowly take up the more contentious ones. The consensus that the Business As Usual was rejected could be a good starting point for the land use planning deliberation. Another such consensus was that no one approves of over exploitation of natural resources, and that everyone cares for the community's prosperity. The meeting could also benefit from an early emphasised consensus that erosion is a risk in the area so that everyone would like to see the land use planning be moderate in erosion risk.

Anticipation of contentious issues could be equally useful, as it would allow the devised land use plan to minimise the potential conflict. An example could be the issue of financial claims by the local communities on companies operating nearby. The concerned parties, both companies and the communities, could be involved in land use planning. They could then be informed that their potential claim conflict could be avoided by not including the potentially disputed area in the forthcoming development zone, but with a risk of lost opportunity. Such knowledge may moderate their positions and drive both sides to a deal before too late.

Other useful information was that stakeholders do not agree on how much development should take place. The Pro-environment and the Pro-community were not sure that big companies would bring prosperity to the local people, that those companies should be supported by the Government, and that modern natural resource development benefits the local people. This would imply the need to devise a mechanism to assure that such local benefits and prosperity do come to reality, if capital investment activities should be included in the land use plan under construction. With such a device provided, it might be easier for the stakeholders to decide how much development they would like to happen in the future, and how much forest they would allow for use.

At some stage the favourite scenario as identified in the graphical Q application could be introduced. It can be developed by incorporating consensus elements from the verbal Q applications, before finally getting into the most contentious ones. During the process, solution to the disagreement could be sought.

Such information would be very important input to the participatory land use planning process in Indonesia. The understanding of the structure of opinions among the stakeholders would help deal with the drawbacks of the participatory approach, i.e. laborious and time consuming deliberations due to lack of direction (see Section II.C.3.c). Solving this problem would allow the stakeholders to complete step 7 in FAO's Guidelines fnior Land Use Planning.

4. A Mixed Approach to Land Use Planning

The combination of verbal and graphical Q applications offers an alternative mixed approach to land use planning. As discussed in Chapter II, a mixed approach attempts to overcome the drawbacks of the rational approach and the communicative approach by incorporating a participatory approach in a rational sequence for identifying and classifying principles, objectives and means of land use planning. The modelling of scenarios in preparation of the graphical Q items provides the rational side of the mixture. Data on the resources and the consequences of interference were used to produce information on the consequences of scenarios. Unlike the Cost Benefit Analysis (CBA) or Total Economic Value (TEV), the scenario models did not attempt to cover the whole set of resources and consequences but only the ones of interest in the light of land use planning.

Use of the information in Q applications allowed consultation of the stakeholders in a participatory process while addressing the rational aspect of land use planning. These resulted in information on stakeholders' preference on the land use scenarios. This information is needed in the ultimate consultation process, which would most likely use one of the participatory policy analysis methods listed in Chapter III, i.e. science courts, scenario workshops, decision conferencing, citizen panels, citizen juries, and consensus conferences. Experience with the multistakeholder forum, which was the inspiration of this study as described in Chapter II, shows that the policy analysis forum found it difficult to arrive to arrive at a new land use scenario without understanding the options and their consequences.

This study is an attempt to offer a method that was called for by Buttoud (2000) who, as quoted in Chapter II, challenges research on mixing the communicative incremental and instrumental-rational approaches.

G. Limitations

Some limitations were identified in the study, which have to be considered in the application of the method recommended.

1. Scenario data for modelling

Data for FOLPI simulation of the scenarios were collected from different sources. The consequence is that they varied in the accuracy levels. Quite detailed data

obtained from BFMP included land maps and the management of natural forest, forest plantation, and oilpalm. Rougher estimated data were used on shifting cultivation (from literature) and coal mining (from the only coal company in Berau). Similarly, the best available ecological data were estimates from a study in a neighbouring district. For example, in the absence of data on the ecological impacts of coal mining, mine opening was treated as a mere clearing of the vegetation, without accounting for the possibly much worse impacts. When available, such negative impact data would sharpen the scenario modelling. Also taken for granted were the financial feasibility of the scenarios, which might be untrue.

2. Person sample

In the verbal Q application, care was taken to select subjects of different occupational background and the three economic, ecological and social aspects. When the same subjects were approached later to do the graphical Q sorts, however, it turned out that the 17 subjects did not explicitly cover the social aspect, though three of them affiliated themselves with the graphical Q Pro-community. This may have played a role in the absence of a Pro-community factor in the graphical Q application.

3. Q concourse and sample

The concourse in the verbal Q application was developed from notes of interviews with stakeholders, plus points excerpted from planning documents. There may have been some bias during the interpretation of the points taken during interviews into the Q statements. While statement editing is a common step in Q applications, this study would have benefited from voice records of the early interviews. Apart from that, there the Q sample or statements, which were selected from the concourse, were not able to reflect the social aspect of the scenario consequences. This was an issue in the graphical Q application, as the scenario consequences, which are to be presented as graphs, need to be inferred from the verbal concourse.

4. Post analysis interview

While post analysis interviews to consult the respondents on the interpretation of the analysis are recommended in Q methodology, though not necessarily a must, in this study this step was not implemented due to resource limitation. Inclusion of this step in

future application would elevate the reliability of the Q analysis interpretation through rechecking with key respondents.

H. Conclusions

a. The scenario factorial design developed in this study was practical. It identified six scenarios with different emphases on the economic, ecological and social aspects. This was a conveniently small number of scenarios, yet covered a broad range of land use issues important for the stakeholders.
b. Data on area and resources involved in the activities of each land use is very important. Such data was available for Berau District, but most likely not for most areas in Indonesia. However, the available data may be applicable to the other areas, with some calibration.
c. FOLPI offers the capability of simulating land use changes and their impacts. It can accept data on areas and the associated resources, accept commands to effect changes of the area, calculate and report the effects of such changes. The reports offered many graphical presentation options. They meet the need as originally contemplated by the Indonesian land use planner, i.e. to understand the impacts of land use changes.
d. Q methodology offers valuable information in natural resource management in Indonesia and other developing countries. Resource management is known to be full of conflicts, and Q methodology is known for its ability to discover different opinions among people, and their groupings. Such information is useful for conflict resolution. There had been a sign of interest in Indonesia among the respondents in this study in using the methodology. Supporting of such prospects is the availability of the analysis software free of charge on the internet, which will relieve users of the painful and complicated manual analysis.
e. As Q methodology applications have been largely used in developed countries, special care has to be taken when trying to apply them in Indonesia. This is especially related to the demand on the respondents in doing the sorting. The card number and contents have to be carefully designed to suit the respondents. This study shows that verbal Q application can be applied in the rural areas of Indonesia. It could be used to learn about the views of literate villagers. The graphical Q application, however, could be used with highly educated respondents, such as

members of the NFP Task Forces that inspired this study. They would welcome the volume of information in the graphs and spend the required time to express their preferences. Thus, the graphical Q application is suitable for consulting the more educated and dedicated stakeholders, while verbal Q application can reach a very broad range of stakeholders, even in the rural areas.

f. The verbal Q application in the case study discovered three types of stakeholders, i.e. Pro-environment, Pro-community, and Pro-business. The three types had both common views as well as disagreements, which can be interpreted as elements of land use scenarios.

g. The graphical Q application also identified three, but different to those above, types of stakeholders: Conservative, Responsible Resource Use and Economic Scale. Unlike the verbal Q application, these factors emerged out of subjects' evaluation of graphically presented scenarios, thus emphasising the impacts. The social aspect was not represented as a factor, likely because the person samples did not cover it, or because the indicators of social consequences were not appropriate.

h. Two approaches were used to identify the most favoured graphical scenario. The first approach used the ranking of scenarios, and the second one involves identification of the least rejection scenarios. The selection of popular and least rejected scenario allows consultation with broader stakeholders, as the number of scenarios to evaluate is smaller and so the required intellectual capability lower. The survey would involve asking a random sample of stakeholders to identify themselves with one of the three graphical Q factors. The result of the survey would be valuable input to deliberations towards a new land use plan.

i. The verbal Q application provides normative information on stakeholder types and their preferences in the form of descriptive elements of land use scenarios and their impacts. The graphical Q application provides positive information on stakeholder types and their preferences in the form of the favourite scenario in graphical presentation. Both types of information are useful for a multi-stakeholder process of developing a collectively preferable land use scenario. Such a process may start with the consensus elements of land use planning which were identified in the verbal Q application, before the favourite graphically presented scenario is presented, and finally the more contentious issues are taken up.

j. The Q applications in this study involved some limitations, including different levels of details of data for the scenario modelling, lack of representation of the social

aspect in the graphical Q person samples and in the graphs, possible bias in the verbal Q statements interpreted from notes of points of interviews, and the absence of post analysis interviews with key respondents. These have to be considered in interpreting the results, and future applications of the method should attempt to minimise these drawbacks.

I. Recommendations

Based on the above conclusions, this study comes up with some policy recommendations. They are the final answer to the research questions, and so are meant as the achievement of the aim of this study. In addition, some further research needs have arisen out of this study, which will be presented at the end.

1. Policy Recommendations

The case study experience has led to a few recommendations for the Indonesian land use planning stakeholders, of which the Government is a major one. The main recommendation is a set of steps that the stakeholders should take in order to solve the problem as stated in the introductory chapter, i.e. failure to put in place a land-use plan that is both sound and effective because it is accepted and supported by the stakeholders. The sets of steps make up a method to help develop a forest-based land use scenario by taking into account stakeholders' preference after considering land-use scenario consequences. The method is presented as a chart in Figure VIII.1.

The recommended method consists of the following elements:

a. Initial Survey

- A survey should start the exercise, using semi structured interviews to find out what the stakeholders want to see, or not to see, happening under their ideal scenario. Additional information can be identified from relevant documents such as report, plans, etc.

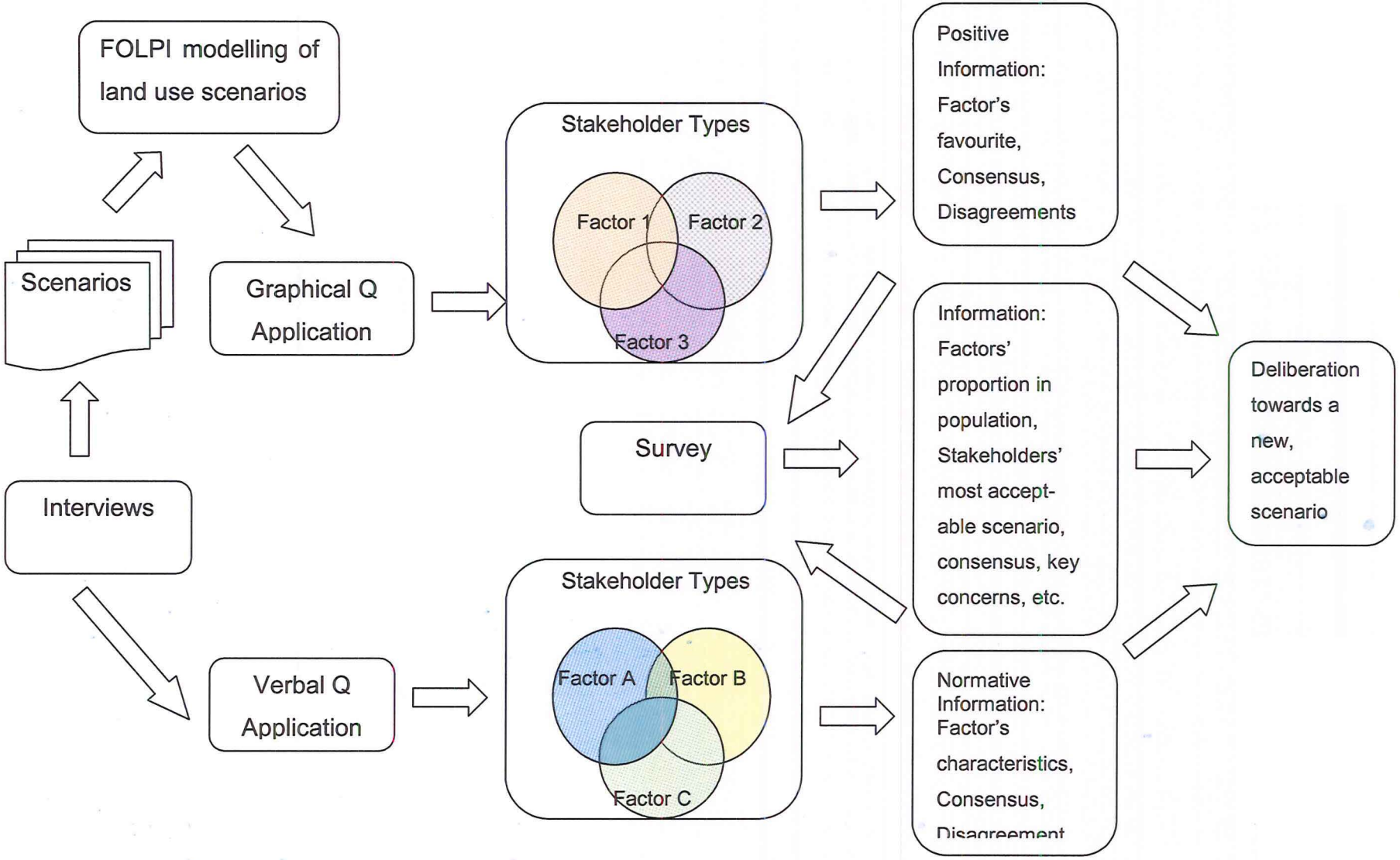

Figure VIII.1: Recommended method of forestry-based land-use planning which takes into account stakeholders' preferences after considering land-use scenario consequences

b. Scenario Simulation with FOLPI

- Based on survey information, eight land use scenarios are identified. The factorial design with variable emphases of economic, ecological and social aspects (Table 4.1) may provide the first six scenarios, and two others are to be identified from the stakeholders' information.
- Eight scenarios are simulated using FOLPI, which are derived from stakeholders' interests. This requires area data for each land use or sub-land use in the initial year, and data on resources involved in their activities. The financial feasibility of each scenario should be considered in future application. If the resource data are not available, Berau data can be the benchmark for estimation. Some types of data may be suitable for direct application in other areas, some may require some calibration and adjustment, some may require supporting data collection. The simulation result are presented in graphs to clearly show the economic, ecological and social consequences of scenarios.

c. Graphical Q Application

- The graphs from FOLPI are presented on cards, with a view to represent the scenario consequences of interest for the stakeholders. The social aspect should be given special attention because it is very subtle to represent. Such care should begin in the initial interviews to develop the Q concourse, and in the subsequent identification of appropriate scenario consequences to represent in graphs.
- The graphs are to be presented for sorting by respondents, who should be the participants in the verbal Q application who are able to do the graphical Q sorting. Given the higher difficulty, there should be as many as possible of them, and they should cover the three aspects quite equally. It should be assured that all potential factors are represented in the Q person samples, including those with social background.
- The favourite scenarios and least rejection by popular choice are to be brought into a survey in order to see the preference of the stakeholder population. The number of scenarios would be quite small, so it should be easier for the stakeholders to rank order.

d. Verbal Q Application

- From the stakeholders' information in the initial survey, a sample of around 22 statements is to be identified using a factorial design as presented in Table 5.1.

They become the Q sample to be presented to a sample of stakeholders identified using the factorial design that appears in Table 5.2. The data analysis should result in a number of factors, i.e. types of stakeholders.

- The proportion of each factor in the stakeholder population is investigated through a survey, in combination with the survey for the graphical Q results above. Q methodology identifies the factors existing in the population, while the actual proportion in the population is left to the survey. A brief description of each factor is to be written and presented to a random sample of the stakeholder population.

e. Resultant Information as Input for Stakeholder Deliberation

- The end results of the method consist of two types of information, i.e. normative and positive. The normative information is the result of verbal Q application, such as the types of stakeholders and the issues each of them most agree with, most disagree with, issues that make them different from the other types, issues of consensus, issues most contentious, etc. Positive information is more objective, such as what kind of scenario each likes best, what that scenario looks like, which scenario would be most acceptable across the stakeholders, which is next, what elements should be considered to modify the one most generally accepted in order to be genuinely accepted by stakeholders, etc. All these pieces of information become input to stakeholder deliberations towards a new and acceptable scenario.

f. General Issues

- Q methodology application should be further explored for helping solved conflicts in natural resource management in Indonesia particularly and developing countries in general.
- The methodology developed in this study, can be applied at all levels, be they district, provincial or national, provided that the two main types of data be provided for each land use, i.e. area data and resources data in time series.
- In such applications, care should be taken to alleviate the drawbacks identified from this methodological case study.

2. Further Studies

During the course of the study, the following issues appear to need further study:

a. Application of the Q methodology in helping solve conflicts in natural resource management in Indonesia should be further explored. This could go beyond land use and forestry issues, such as mining, agriculture, fisheries, etc.
b. The use of graphs on Q cards should be further pursued. Different options of graphs to represent issues, as well as the different levels of difficulties should be evaluated.
c. Application of the method developed in this study should address the issue of the absence of the Pro-community factor in the graphical Q application. Different graphical presentations of this aspect should be attempted for that purpose.

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ANNEX I
FOLPI AND ITS APPLICATION IN THE STUDY

A. Introduction

This annex presents the FOLPI application in detail. While these details would be distracting if put in Chapter IV, they are still necessary as references on how to use FOLPI in the method that is recommended in this study. For that purpose, first the method of application is described, followed by its application and results.

B. Method

3. Land Use Planning Issues

Interviews were used to learn what land use planning issues the stakeholders deemed important. The information sought included the kinds of land use changes that the subjects would like to happen or not, and the kinds of impacts they are worried about.

4. Scenario Development

Scenarios were developed with a view to cover options as widely as possible. The width of the options is related to the issues considered important by the stakeholders. This is related to the need for the Q-Methodology to ensure representativeness of the Q-sample, which will be reported in the next chapter.

5. FOLPI Application

There are two major works in the use of FOLPI, i.e. files preparation and model development. FOLPI interrogated a number of files during program runs. They were Area, Yields, Products, Thinnings, Plant, and Overheads files. The first four were the results of reformation of a single Data File, using the utility Transfor in the IFS (Interactive Forest Simulator). So, there were only three files to prepare: Data File, Plant File, and Overheads File. The first one was the main and largest file, while the other two were relatively more simple, smaller files. The three files could conveniently be developed in Excel before being saved as a text file, as will be

described below. Development of these files involved the concepts of croptype and rotation, which will be first described here.

a) Croptype and Rotation

In the original forestry application, a croptype is an aggregation of stands which may differ in age but are regarded as uniform in terms of future management and yield production (Manley and Threadgill 1991; Forest Research Institute 1993). In this study, croptype refers to any land use that has the same future management and yield production. A land use may comprise a number of croptypes if there are variations of management and yield production.

Rotation is understood in this study as the period in which a set of management interventions is applied to a croptype. An example is the eight-year rotation of *Acacia mangium* plantation, with the set of management interventions starting from planting until finally harvesting. Rotation is relevant to croptypes that are harvested, including natural forest, which is selectively cut every 35 years. It is not relevant to croptypes that are not harvested, such as sustainable shifting cultivation, which is treated as being annually thinned for a value lump-sum from various products.

b) Data File Preparation

The Data File contains a table for each croptype. In the standard forestry application of FOLPI, the first column contains the age classes, which extends to the oldest age expected during the simulation. The second column contains the wood recoverable at each age class. The next columns are for intermediate or thinning yields, i.e. any resources occurring prior to final harvest. Common intermediate yields are production thinning yields, and their associated costs and revenues, as well as silvicultural costs. The last columns of the Data File table are for final products, which are the breakdown of the final yield. For example, the total recoverable wood may comprise veneer log, saw log, and pulp log. Table Annex 1.1 presents these categories in a table format.

Table Annex-1. 1: A spreadsheet example of the standard Data File format for a croptype

Age Class	Final Yield	Thinning Yield	Thinning Cost	Thinning Revenue	Silviculture Cost	Veneer-log	Saw-log	Pulp-log
1								
2								
...								
Oldest in simulation								

Note: Final Yield = Veneer-log + Saw-log + Pulp-log

In this study the format can be adjusted to accommodate the non-forestry croptypes. Unlike in the forestry application where wood is the common yield, different land uses, which make up the croptypes, have different yields. However, as the land use planning is forestry based it is assumed that the final yield is wood. Non-forestry croptypes have zero values for the final yield. Their yields are considered intermediate yields. This should not be a problem, especially as FOLPI was used for simulation rather than optimisation. Both final and intermediate yields will appear in the FOLPI modelling results anyway.

c) Plant File Preparation

The Plant File is relatively simple to develop. The first row is for the names of the products, and the next rows for their corresponding values. The first column gives the name of the croptypes, and the next columns give values of costs or revenues per unit area associated with planting, including its preparation. These can be new planting from bareland, and replanting into same or different croptypes. The different croptype could be bareland, meaning that the area is not replanted. This means liquidation, which may involve some revenue from sale. The format is presented in Table Annex 1.2.

Table Annex-1. 2: A spreadsheet example of the standard Plant File format for all croptypes

CROPTYPE	NEWPREP (cost)	NEWPLANT (cost)	REPREP (cost)	REPLANT (cost)	LIQUIDATION (revenue)
1					
2					
...					
Last					

d) Overheads File Preparation

This file contains annual maintenance cost per hectare for each croptype. The structure is most simple. It contains just two columns, one listing croptype names, the other the associated overhead costs.

e) Model Development

FOLPI problem formulation is guided in full in the Forest Research Institute (1992). It includes the setting of the length of the planning period, minimum and maximum clearfell ages for each croptype, the replanting strategy, allowable area transfers between croptypes, the objective function and constraints. These are described briefly below in relation to their application in this Case Study.

Planning period. The length of the planning period is typically around one and a half or two rotations (Forest Research Institute 1993). The croptype with the longest rotation becomes the reference.

Minimum and maximum clearfell ages. In the original FOLPI application for optimisation, the minimum and maximum clearfell ages for each croptype are based on biological and economic consideration in order to maximise revenue. In this case study, however, the need for strictly controlling the model often means that the

clearfell threshold should be set differently from time to time to allow clearfelling of the older areas first.

Replanting. A replanting strategy prescribes the management options for clearfelled areas. They can be replanted into the same croptypes, into different croptypes, or into bareland, which means they are not replanted. A related concept is the transfers between croptypes. In FOLPI it is possible at the start of the modelling period to allow change of management prescription for a croptype, which makes it belong to another croptype.

Objective function. The most common objective function options are to maximise revenue or to maximise volume. A third option is actually available, which is to allow consideration of the different prices of products. In the case study, it does not really matter which objective is pursued, as the models are controlled so tightly that they do not optimise at all.

Cut and replanting constraints. Constraints are restrictions imposed on the resources. Cut constraints can be: non declining yield, smoothing constraints, cut constraints, replanting constraints, new land planting constraints, and custom constraints on a list of products. They are commonly used in optimisation. As in the case study no optimisation was attempted, generally only two types of constraints were used, i.e. cut constraints and replanting constraints.

Cut and replanting constraints are important for modelling the scenarios. They can be used to represent the direction and magnitude of the flow of area from one land use to another. The information on land use changes in the scenarios could be obtained from maps, plans, current practices, and so forth.

J. FOLPI Application

As mentioned in the section on method above, running models in FOLPI needs Data File, Plant File, and Overheads File. The approach to the development of these three files is described below, but first is the approach to the two underlying concepts of croptype and rotation.

1. Croptyping

The main reference for identifying the croptypes is the Detailed Land Use Changes in Kabupaten Berau, 1997-2000 (Steenis 2001), which was based on the theme table of a

Landsat-based map of Berau District land-uses. The land-use classification is quite extensive – including 45 classes. They were regrouped and selected into land-uses that were significant in terms of land-use changes in the District, as presented in Table Annex 1.4.

Table Annex-1. 3: Croptyping of Berau District for FOLPI Modelling of Land-use Scenarios

Croptype	Description	Land-Uses*) Involved
ACAMA 0-5	*Acacia mangium* Forest Plantation, including Gmelina plantation As Acacia plantation was projected to improve in its productivity due to tree improvement, each rotation was represented by a different croptype (ACAMA 0 – 5). ACAMA 0 refers to new plantation from grassland.	Forest plantations – Acacia (Pfa) Forest plantations – Gmelina (Pfg)
VIRGINCON & VIRGINMNG	Virgin Forest: VIRGINCON refers to Conservation Virgin Forest, i.e. to remain virgin through allocation as protection or conservation forest. VIRGINMNG refers to Managed Virgin Forest, i.e. allocated for harvesting.	Moist primary submontane** forest (Hf) Moist primary lowland*** forest (Hh) Moist primary lowland forest with bush (Hh+B) Forest on calcareous rocks (Hi) Swamp forest (Hr)
LOGFOR	Logged Over Forest	Moist logged submontane forest (Hfx) Logged forest on calcareous rocks (Hix) Logged forest – very healthy (HxLVD) Logged forest – healthy – disturbed (HxLVB) Logged forest – very healthy – recently disturbed (HxLVG) Logged forest – healthy – disturbed (HxLDB)
SECFOR	Secondary Forest	Logged forest – unhealthy – highly disturbed (HxLDG) Logged forest – very unhealthy – disturbed (HxLDY)
OILPALM0 and OILPALM1	OILPALM0 refers to Oil Palm Plantation planted from grassland; OILPALM1 refers to Oil Palm Plantation replanted from formerly forested land or from itself.	Oil Palm Plantations (Pp)
COAL	Coal Mining	Coal Mining (Tc)
SHIFT	Shifting Cultivation, the traditional sustainable one	Shifting cultivation (L)
SFSHIFT	Short Fallow Shifting Cultivation, the unsustainable one	Shifting cultivation (L)
GRASS	Grassland	Grasslands (R) Imperata cylindrical grassland, grazed and burned yearly (Ra) Imperata cylindrical grassland with bush (Ra+B) Imperata cylindrical grassland with crops (Ra+L) Unvegetated area/bare soil (T)

Note: *) As listed and coded in Steenis (2001);

) 1000-2000 m above sea; *) <1000 m above sea

The above regrouping does not include a number of land-use classes that are less significant in terms of land-use structure changes, i.e. heath forest, coastal forests, settlements, home-gardens, wetlands, industrial area (pulp mill), rock outcrops, lake and lagoons, and fish ponds. It was assumed that these land-uses were not subject to significant changes under any scenarios.

2. Planning Period and Rotation

The planning period is set as 50 years, about 1.5 times the length of the longest rotation of the croptypes.

Computationally the FOLPI Data File requires that all croptypes have the same rotation. For this purpose all croptypes should be regarded as having the rotation of the longest age expected during the 50-year simulation. This was assumed to be 70 years, i.e. twice the natural forest rotation of a 35-year cycle. All croptypes are set to grow until age 70, mostly by allowing them to stay in the same state of the final age of their normal rotation. This should not be a problem of representation, as the model can be set to disallow croptypes to grow beyond certain ages.

3. FOLPI Data File

The data file contains sixteen tables, one for each of the sixteen croptypes. Each croptype's table has fifteen columns giving different features of the croptypes, and seventy rows representing possible ages in any croptype. In FOLPI the croptype features are called 'products' or 'yields'. The fifteen products or yields in the Data File of the Case Study are described in Table Annex 1.5 below. All croptypes have the same number of products even if they are irrelevant for them, in which case zero will be entered.

Column 3 contains information about whether the product is final or intermediate. As mentioned in the section on method above, final products accrue in the clearfelling year, such as final yield and its components (e.g. wood and its components timber and pulpwood). On the contrary, intermediate products (such as operational costs and oilpalm yield) accrue any time prior to clearfelling.

Table Annex-1. 4: Description of the Products of the FOLPI Data File of the Case Study

No.	Product	Final/ Intermediate	Relevant Croptype	Description
1	AREA	General	All	This column gives area distribution per age class at the base year 2000. The total area of each croptype is spread over each period in the rotation, with zeros filled when there is no area of that age.
2	YIELD	Final	ACAMA0-5 VIRGINCON VIRGINMNG LOGFOR SECFOR COAL	This refers to clearfelling wood yield, following the convention of FOLPI as a forestry-based modeling system. Wood YIELD consists of two products: TIMBER and PULPWOOD. Timber yield accrues in natural forest croptypes, including COAL, which grows into secondary forest.
3	OCOST	Intermediate	All	Standing for operational cost.
4	OLAB	Intermediate	All	Standing for operational labour
5	OILPALM	Intermediate	OILPALM	Product of oilpalm plantation in the form of palm oil.
6	SHIFTREV	Intermediate	SHIFT SFSHIFT	Standing for shifting cultivation revenue.
7	COAL	Intermediate	COAL	A one off product of COAL croptype which accrues in year 2
8	SOILCOST	Final	All	Referring to the cost of handling soil damage done by the land use scenario.
9	BIOINDEX	Final	All	Referring to biological diversity index held under a certain land use scenario.
10	CSTOCK	Final	All	Referring to carbon stock under a certain land use scenario.
11	TIMBER	Final	VIRGINCON VIRGINMNG LOGFOR SECFOR COAL	Timber refers to wood yield from natural forests.
12	PULPLOG	Final	ACAMA0-5	Pulplog is wood yield from plantation forests.
13	HREV	Final	All	Standing for harvest revenue. Note: it accrues at the harvesting year of the croptype and does not accrue yearly in croptypes that are treated as annually production-thinned.
14	HCOST	Final	All	Standing for harvest revenue. Above note (for HREV) applies.
15	HLAB	Final	All	Standing for harvest revenue. Above note (for HREV) applies.

The following section describes the approach to data collection for each land use. First it revisits the croptyping approach, then continues with approaches to data on the area, yield, financial and labour resources, and ecological impacts. As the data refer to sources from different times, the financial figures were deflated to year 2000 value based on the corresponding consumer price indexes.

a) Forest Plantations (ACAMA 0-5)

Croptyping. As described in Table Annex 1.5 above, *Acacia mangium* plantation is assumed to have six possible croptypes. This refers to the estimation made by PT. Tanjung Redep Hutani, the only significant forest plantation company in the district, that tree improvement would gradually increase production. As stated in its Production Projection 1993-2035 (PT. Tanjung Redeb Hutani 2001: p.IV-25), with management interventions such as tree improvement and tending, yield/ha at age 8 in the consecutive rotations are 100, 100, 150, 175, and 200 m^3/ha (p.IV-25). This yield development becomes the basis for croptyping the forest plantations, i.e. into ACAMA 1-5. Another croptype, ACAMA 0, is created to represent plantations established on grassland, of which the production rate is assumed to be 80% of that established on cleared forest as usual.

Area. In Berau District there was practically no forest plantation operation other than that of PT. Tanjung Redep Hutani. Area data quite simply follows the company's management plan, as presented in its Attachment 01 (PT. Tanjung Redeb Hutani 2001). Plantations established during the first rotation (1993-2000) belong to croptype ACAMA 1; those established in 2001 belong to ACAMA 2.

Yield. Data on yield development during the rotation period was available from NMFP's[11] Production System Database (Indonesian Ministry of Forestry 1994; Indonesian Ministry of Forestry 1995). The database uses a set of assumptions on tree growth in different circumstances and the impact of management on the growth and production rates to estimate potential production of 60 species (including *Acacia mangium*) in different circumstances under different management interventions. The outputs of the Production System are yield, cost, revenue, and financial analyses. The yield prediction of PT. Tanjung Redep Hutani above corresponds to the Production System's prediction for *Acacia mangium*'s performance at Suitability Rating 7 with the management penalty gradually reduced from 50% in rotations 1 and 2, to 35%, 25%, and 0% respectively in Rotations 3, 4, and 5-6. This allows reference to the NMFP Production System output for developing the yield tables for *Acacia mangium*

[11] NMFP stands for National Masterplan for Forest Plantations. It was produced by a World Bank funded project of the Indonesian Ministry of Forestry in 1993-1995

in each rotation (ACAMA 1 through 5). ACAMA0, which grows from grassland, is assumed to perform at 80% of ACAMA1.

Financial Resources. Costs and revenues calculations were based on the management plan of PT. Tanjung Redeb Hutani (2001). OCOST (operational cost) consists of silvicultural costs and protection costs. HCOST (harvest cost) refers to the felling cost. HREV (harvest revenue) was based on the company's pulplog transfer price of Rp. 288 000/m3 (p. V-6) and the yield table. There is no thinning.

Labour. Data for OLAB (operational labour) and HLAB (harvest labour) is available in the company's management plan, i.e. in its Attachment 11 on the detailed calculation of labour and general activities costs (PT. Tanjung Redeb Hutani 2001).

Ecological Impacts. Three ecological impacts are considered in the Case Study. This follows a study in a neighbouring district of the same province of East Kalimantan carried out by Kosonen et al.(1997). For SOILCOST (soil erosion cost) estimation, it was assumed that the land slope is 18% maximum. This gives a maximum soil cost of 0.55 US$ /ha/year, the average of the first two slope ranges in Table Annex 1.6 in the article, at the entry to the *Acacia mangium* plantation. It was assumed that the plantations grow from bare land conditions, for which the soil cost is 5.55 US$/ha/year. The BIOINDEX (biodiversity index) is similarly estimated by referring to Kosonen's Table 9, and for CSTOCK (carbon stock) the reference are Tables 7 and 8, which shows that the carbon stock of a mature *Acacia mangium* plantation is 215 tonnes/ha. The starting point is assumed to be 10 tonnes/ha, which is less than that of Imperata grassland of 45 tonnes/ha.

b) Natural Forests (VIRGINCON, VIRGINMNG, LOGFOR and SECFOR)

Croptyping. Virgin forests are distinguished on the basis of their future management. There are virgin forests for conservation purposes (VIRGINCON) and virgin forests to be managed for production purposes (VIRGINMNG).

Area. VIRGINCON is assumed to be the 353,775 ha classified as protection forest in the District Government statistics (Berau District Centre for Statistics Services 2001). As the total area of virgin forests as calculated through reclassification of the land uses in Steenis (2001) is 500,699 ha, it is assumed that the remaining virgin forest of 146,924 ha falls under the production function.

VIRGINCON and VIRGINMNG are old growth forest. For the modelling purpose, however, their allocation in the age classes is such that allows their cutting as required in each scenario.

The calculation found that LOGFOR covers 888,298 ha and SECFOR 336,202 ha. Both croptypes are assumed to grow in a 35 year cutting cycle, hence are spread over the first 35 years of the 70 age-class area-column.

Yield. For yields of natural forests, this Case Study adopts the estimates in BFMP's Minimum Area Model i.e. virgin forest yields 35 m3/ha and logged over forest 29.8 m3/ha. This Case Study assumes that the secondary forest's yield is 15 m3/ha, which is an average yield of poor forest, of which the legal upper threshold for conversion is 20 m3/ha.

Financial Resources. Costs and revenues estimations follow BFMP's Excel Model for Minimum Area Unit, more particularly in its Unit Cost Component worksheet. VIRGINCON is assumed to bear no operational cost (OCOST), unlike VIRGINMNG and SECFOR, which bears protection costs. As fully managed forest, LOGFOR bears the full list of operational costs. HCOST comprises the sum of harvesting costs and Government levies. Harvesting costs are valued per m3, and consequently HCOST is different between VIRGINCON/VIRGINMNG, LOGFOR and SECFOR as they differ in yields per hectare. HREV is based on the price of the timber of 65 US$/m3 as used in PT. Tanjung Redeb Hutani (2001).

Labour. With natural forests, practically all labour is related to harvesting, as protection, the other management activity, is done by permanent staff whose per hectare number is so small that it can be ignored. The figures were derived from BFMP's Model for Minimum Area Unit. Harvesting related labour consists of road construction and maintenance, and the tree felling and transporting. Road construction labour was calculated from data on road density per hectare, machines' productivity per hour, the number of workers per machine and working hour per day. Tree felling and transporting labour was counted from data on timber production per hectare, machines' productivity per hour, number of workers per machine, and working hour per day.

Ecological Impacts. As with the forest plantation above, estimates for the three ecological impacts also refer to Kosonen et al.(1997). They come under the entry 'primary dipterocarp forest'. The rates for VIRGINCON and VIRGINMNG were held constant along the modelling period. Data were also available for

LOGFOR, which is assumed to develop linearly into nearly (90%) the condition of virgin forest. For SECFOR, the SOILCOST was assumed to refer to the 'extrastatistical logging' entry in Table 6 of Kosonen et al.(1997); The CSTOCK data is available for secondary forest (204 tC/ha) at mature state, and it was assumed to decline by 20% at logging time. Straightforward data on BIOINDEX is not available for SECFOR, and it was assumed to be 80% of that of LOGFOR.

c) Oilpalm Plantation (OILPALM 0, OILPALM)

Croptyping. Oilpalm plantations are distinguished between the more common, which are established on cleared natural forest (OILPALM), and the ideal ones planted on grassland (OILPALM 0). This separation is to account for the higher productivity of the former as compared to that of the latter.

Area. Following Steenis (2001), agricultural plantation covers 1,029 ha. Based on information obtained from an interview with an official of Berau District Agricultural Plantation Services, it is assumed they all belong to OILPALM croptype and are spread over the first six age classes.

Yield. Oilpalm yield data is obtained from BFMP's '*Analisis Finansial Kelapa Sawit*' (Oilpalm Financial Analysis). The yield/ha rate was obtained from a weighted average of the company's (40%) and the farmer's (60%) production level of oilpalm fruit. The conversion factor into the final products of oil is 0.21.

Financial Resources. Costs and prices follow NMFP's Excel Model Oilpalm Financial Analysis. OCOST consists of plantation tending costs and infrastructure maintenance costs. HREV and HCOST are valued per unit (kg) of oilpalm yield, and so it is easier to calculate them in a spreadsheet.

Labour. As oilpalm is treated as a croptype that is production-thinned yearly, all labour is included in OLAB (operational labour). The data was taken from a detailed breakdown of labour requirements for every management activity in BFMP's Excel Model Oilpalm Financial Analysis.

Ecological Impacts. Estimates for the three ecological impacts also refer to Kosonen et al.(1997), in which *Acacia mangium* has its own entry. It is assumed to grow from bareland.

d) Coal

Croptyping. All coal mining areas are assumed to be uniform in yield and future management treatment, and therefore they are in a single croptype COAL.

Area. Mining area estimation was based on the production rates of PT. Berau Coal[12], the only coal mining company in the district, and mining reserve rate from a previous Environmental Impact Study series (PT. Berau Coal 2000)

Yield. Coal production rate is assumed to be 53,686 tonnes/ha, on the basis of a previous Environmental Impact Study (PT. Berau Coal 2000).

Coal mining areas are assumed to be open for five years, and rehabilitation starts at year 3. Rehabilitation is assumed to grow the area linearly into a secondary forest by the end of the 35-year cycle, and then continue growing into logged over forest (29.8 m3/ha) during the next 35-year period.

Financial Resources. Cost and revenue estimates for coal production were based on data provided by PT. Berau Coal. Cost and revenue values were available in US$/ton. This allowed calculation to be done in a spreadsheet, based on coal production.

Labour. The estimate of labour per mining hectare was derived from data on labour required per active hectare (2.64 labour/ha), the duration each hectare is active (nearly 3 years), and the ratio between open area and real producing area (2.5).

Ecological Impacts. Mining area is considered to be cleared in the same way as in plantation establishment. It is assumed to regrow from bareland at the mining year into secondary forests in seventy years. It should be noted that due to lack of data no attempt has been made to account for environmental impacts other than on these three aspects.

e) Shifting Cultivation (SHIFT, SFSHIFT)

Croptyping. Shifting cultivation is distinguished between the traditional, sustainable one and the other, which is short-fallowed and unsustainable. The former is practised by tribal communities who inherit the knowledge from their ancestors, while migrants who are used to sedentary agriculture, which is unsuitable for the condition, commonly practise the latter.

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[12] http://www.beraucoal.co.id/ aboutus/index.html accessed on 14/8/2002

Area. According to Steenis (2001) 5,250 ha were identified as dryland rice fields in 2000. This is assumed to be half the actual shifting cultivation, the other half being abandoned and identified as bush. Another assumption is that of the total 10,500 ha, 60% is sustainable (SHIFT) and the other 40% is unsustainable (SFSHIFT). The unsustainable area spreads over the first six years of the planning period.

Yield and Financial Resources. The value of sustainable shifting cultivation per hectare was calculated from the data from a study in a neighbouring area in East Kalimantan (NRM/EPIQ-Program and SHK-East-Kalimantan 2000). That study evaluates household income from shifting cultivation, referring to it as Customary Forest Management System (CFMS). It collected data on income per household from different activities. The participation rates were different between the three villages under study, against which the income figures were weighted. This was divided by 25, the assumed number of hectares used by each household for the activities. The average from the three villages was US$64.2 in 1999, which was equivalent to US$72.2 in 2000 after adjustment using the corresponding Consumer Price Index. This is taken as the amount accruing from each hectare of shifting cultivation area. The calculation appears in Annex IV-6.

For the unsustainable SFSHIFT, the rice is treated as thinning yield, with the amount and revenue and operational costs following Magrath et al. (1995). It is also assumed that the production value decreases in such a way that in 25 years it can not meet the production cost any more.

Labour. The labour requirement of SHIFT is based on the NRM-EPIQ data (NRM/EPIQ-Program and SHK-East-Kalimantan 2000) which assumed that 25 hectares were managed by a household with an average of 2.5 workers who work 81 days per year, thus giving 8.1 workdays per hectare.

Labour required for SFSHIFT refers to Dove (1985), who estimates labour needs of each activity in dry-land rice cultivation to be 167.8 workdays/ha. It is assumed that labour needs slightly increase in the subsequent years due to increased need for weeding. The calculation is presented in Annex IV-7.

Ecological Impacts. SOILCOST, BIOINDEX AND CSTOCK for SFSHIFT refer to Kosonen et al.(1997) under entries extensive agriculture, intensive agriculture, or annual crop. Their condition is assumed to improve during the fallow period,

before again being cleared. In these ecological terms the sustainable SHIFT is treated as between LOGFOR and SECFOR.

f) Grassland (GRASS)

This last croptype does not bear any yield, financial resources, and labour. Only ecological impacts are relevant. In Kosonen et al.(1997) it comes under the entry of bare land or Imperata grassland.

4. FOLPI Plant File

The Plant File contains cost and revenues associated with establishment, which may include planting of new land (bareland), replanting into the same or different croptype, and liquidation, i.e. not replanting, or replanting into bareland. The Case Study does not involve any planting from and into bareland, and so NEWPLANT and NEWPREP are not necessary. Revenue accruing from replanting forests into plantations was dealt with in a spreadsheet outside FOLPI modeling. Therefore, the Plant File only has two products, i.e. REPREP and REPLANT.

Only forest plantation and agricultural plantation croptypes involve replanting resources, as the rest regrow without any intervention after harvest. Data for forest plantation refers to PT. Tanjung Redeb Hutani (2001) and for oilpalm plantation to BMFP's Excel Model for Oilpalm Financial Analysis.

5. FOLPI Overheads File

The Overheads File is even simpler than the Plant File, as can be seen in Annex IV-9. It simply consists of a column listing croptype names and another listing their corresponding overhead value. Only forest plantation (ACAMA 0-5), managed natural forests (VIRGINMNG and LOGFOR), and oilpalm plantation involve overhead costs; the rest do not.

The forest plantation overhead cost refers to data from PT. Tanjung Redeb Hutani (2001), that for natural forests refers to BFMP's Excel Model for Minimum Area Unit, and for oilpalm plantation to BMFP's Excel Model for Oilpalm Financial Analysis. In all the three sources the data comes under the entry of Investment.

6. Model Development and Runs

With a view to modelling the six scenarios in Table Annex 1.3 above, the first attempts were to model the Business As Usual scenario and the District Government scenario. The results were subsequently evaluated to see how they fit in the matrix.

a) Business As Usual Scenario

The ongoing land-use scenario in Berau District was inferred from a study in 2000 by Steenis (2001). He concluded that forest cover in Berau District had decreased by 128,000 ha or six percent between 1997 and 2000. This conclusion was based on interpretation of Landsat imageries acquired in 1997 and in 2000. The Business as Usual (BAU) scenario was built on the trend over the three years. The 45 land uses were regrouped, as described in the section on croptyping above. A comparison between the two years is presented in Table Annex 1.6. The table indicates whether a croptype increases, decreases, or remains stable during the three years lapse. These trends indicate the flow of areas between land uses, which was illustrated in Figure Annex-1.1. The illustration involved modelling of the area flow and rounding up numbers, which caused some discrepancies of the sums from the original.

Table Annex-1. 5: Land use areas in Berau District in 1997 and 2000 (figures in hectare)

No	LAND USE	1997	2000
1	Virgin forest	524,510	500,699
2	Logged over forest	1,050,272	899,235
3	Secondary forest	272,550	336,202
4	Forest plantation	27,050	74,018
5	Oilpalm plantation	0	1,029
6	Grassland	14,013	0
7	Bareland'	112	6,246
8	Coal mining	358	1,686
9	Shifting cultivation	3,977	5,175
10	Total	1,894,839	1,826,290

The scenario diagram became the basis for developing the FOLPI model for Business As Usual. Using IFS' Transform utility, the Data File prepared in the way

described above was reformatted into the Area, Yields, Products, and Thinning files. These four files, along with the separately prepared Plant and Overheads files, were then retrieved in FOLPI. The model was developed by setting the minimum and maximum clearfelling ages, the replanting options, objective function, and the cut and

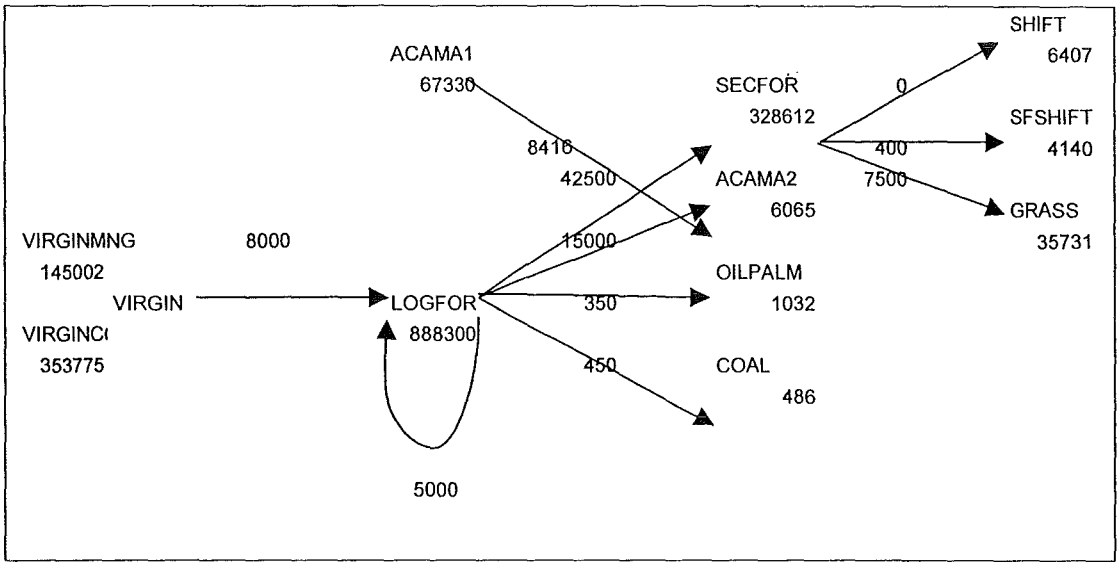


Figure Annex-1. 1: Land use flow diagram under Business As Usual scenario

replanting constraints. The FOLPI model of the Business As Usual scenario appears as Annex IV-11. Below is a brief description of it.

Minimum and maximum clearfelling ages. For forest plantation, in 2001 there were 67,330 ha in rotation 1 (ACAMA1) and 6,065 ha in rotation 2 (ACAMA2). ACAMA1 was to be harvested during the rotation starting from 2001 (rotation 2). This means a harvest of 8,416 ha/year, which requires a minimum age of 7 years and maximum of 10 years. Their immediate replanting, along with new planting from logged over forests, adds to the existing 6,065 ha of ACAMA2. The total is 193,376 ha, which means that the next rotations cut is 24,172 ha/year. This allows a minimum age of 8 years and a maximum of 9 years.

For VIRGINCON and VIRGINMNG, the age does not matter as it is old growth, and so the threshold was set liberally from 1 minimum to 90 maximum. However, as VIRGINCON is to be cut only after VIRGINMNG is finished in 18 years, the cutting age threshold is set extremely high for VIRGINCON to prevent its cutting for the first 18 years.

LOGFOR is slightly different because it has regrown from a previous cut and so it has age gradation. In order to allow cutting of the oldest forests available, the minimum age was set as 23 years in the first rotation, 15 years in the second rotation, and after that 1 year. For a similar reason, SECFOR's minimum clearfelling age was set as 16 years, the maximum being set liberally as 90 years.

Oilpalm plantation is technically to be replanted at age 25, and so the cutting age thresholds were set tightly accordingly. A shifting cultivation area, which is being thinned yearly, and grasslands are not to be cut and their clearfelling threshold was set extremely high.

Replanting Options. The replanting options are mostly obvious from the scenario diagram above, and only additional features are described here. For *Acacia mangium plantation, which is* not obvious from the diagram, the croptyping basis suggests that they are replanted from one rotation to the next: ACAMA0 to ACAMA1, ACAMA1 to ACAMA2, and so on. Virgin forests (VIRGINCON, VIRGINMNG) are replanted into logged over forests (LOGFOR), which then can be replanted into secondary forests, forest plantation oilpalm plantation, and coal mining.

It is important to specify in what periods each option is allowed. This is especially true in this Case Study, where FOLPI is used for simulation rather than optimisation. For example, LOGFOR is allowed to be replanted into ACAMA2 in the first rotation only. This allowable period must be explicitly specified to prevent the model doing it for optimisation.

Objective Function. As in this application FOLPI is not used for optimisation, the objective function does not matter. The models are set to maximise revenue, but they do not really do it because they are so tightly controlled.

Replanting Constraints. In this model, the cut constraint is affected by the replanting requirement. The replanting from one croptype to another is indicated by the flow diagram in Figure IV-3 above. The right side of the diagram shows that each year 400 ha of SFSHIFT, 7,500 ha of grass, and 12,500 ha of BARELAND are created from SECFOR, throughout the fifty year planning period. The middle part of the diagram shows the flow of LOGFOR into SECFOR, ACAMA2, OILPALM, COAL, and into LOGFOR itself. Replanting into ACAMA2 only takes place in the first eight years, as clearly indicated by actual practice in Berau District. Replanting

into SECFOR is decreasing due to lack of available LOGFOR area, from 42,600 ha/year in the first 21 years, then 26,200 ha in year 23, and then 7,200 ha/year in the remaining years. Replanting into itself, which represents a proper management of production forest, only takes place in the first eight years, before the LOGFOR area crisis starts.

The cut constraints followed the scenario diagram. As already described in the discussion on the clearfelling age threshold above, the *Acacia mangium* plantation is cut at the level of 8,415 ha/year in the first rotation, and 24,172 ha/year in the subsequent rotations.

Virgin forests are cut at the level of 8,000 ha/year, first affecting VIRGINMNG until it is finished, before affecting VIRGINCON.

LOGFOR's cut is also suggested by the flow diagram. In the first eight-year rotation it is 63,300 ha/year, to become 48,300 ha/year in the second rotation because of less (15,000 ha/year) cut for forest plantation in the first rotation. In the third eight-year rotation the cut is further down to 43,300 ha/year, as replanting into itself is not done due to lack of area left. At this cutting rate, the remaining LOGFOR area, including the new area resulting from the clearfelling of virgin forest, i.e. 243,500 ha in total, runs out in five years. The remaining 27,000 ha are cut in the sixth year of the rotation, after which the cut level remains at 8,000 ha/year, i.e. the area coming from virgin forest cut every year.

SECFOR is cut at a rate of 20,400 ha/year through out the planning period. OILPALM is cut when it reaches the age of 25 years.

Result. As presented in Section IV.G of this thesis, the model was run and the results retrieved as spreadsheets. Summary results were produced, which reported the dynamics during the 50 year modelling period in terms of: cut, residual, thinnings, planting, and overheads.

In the same way, also developed were graphs on the economic impacts, ecological impacts, and social impacts of the scenario were also developed. For example, the net revenue impacts graph appears in Figure IV-5.

b) District Government Scenario

With the help of a consultant team from BPPT (Agency for the Assessment and Application of Technology) Jakarta, Berau District Government produces a Draft Land-Use Planning 2001-2011 (Berau, District Government 2001). Cross tabulation of the accompanying digitised map against the land-use map 2000 resulted in a land-use change track (Table Annex 1.7), and subsequently a croptypes flow diagram (Figure Annex-1. 2), which was then interpreted into FOLPI modeling instructions.

Table Annex-1. 6: Land use change track from Year 2000 Land Uses to District Plan Land Uses Year 2011 (all figures in hectare)

Land Use District Plan:	Convertible Forest	Protection Forest	Production Forest	Limited Production Forest	Agricultural Plantation	Dryland Farming	Grand Total
Land Use 2000:							
Virgin Forest	1,902	418,590	4,482	95,360	4,396	9,622	540,840
Logfor	63,240	147,197	103,908	447,713	82,836	86,298	942,948
Secfor	7,646	28,314	100,297	136,014	18,707	1,928	322,289
Forest Plantation	51,565	0	5,597	12,522	4,058	9,215	83,447
Oilpalm	0	0	0	0	0	1,043	1,043
Grass	10,085	1,462	8,090	2,273	3,942	704	35,257
Bareland	1,880	55	1,269	860	232	301	6,629
Coal	0	0	0	0	1,540	0	1,676
Shifting Cultivation	0	0	1,883	203	44	49	5,188

The FOLPI model is more complex than the Business As Usual scenario, because it is fully based on the overlaying of two maps – Berau Land Use in 2000 and the District Plan for Land Use in 2011.

The flow of resources is reflected by the **Cut and Replanting Constraints.** Under the District Scenario, virgin forests are allowed to become not only logged over forests as assumed in the Business As Usual scenario, but also oilpalm plantations and

shifting cultivation areas. The District Government plan allocates just over 100,000 ha of virgin forest to be clearfelled and replanted into logged over forest, oilpalm plantation and shifting cultivation.

Logged over forest under this scenario is mostly managed as a production forest (15,000 ha/year), and also into forest plantation (ACAMA2, 15,640 ha/year), oilpalm (14,000 ha/year), shifting cultivation (8,265 ha/year) and coal (around 250-700 ha/year).

Secondary forest is also mostly managed as a production system, i.e. harvested and regrown into itself. Around 100-400 ha/year is opened for mining.

The District Government scenario also shows the intention to cultivate grassland. Some is regrown into secondary forest (1,365 ha/year), some into oilpalm

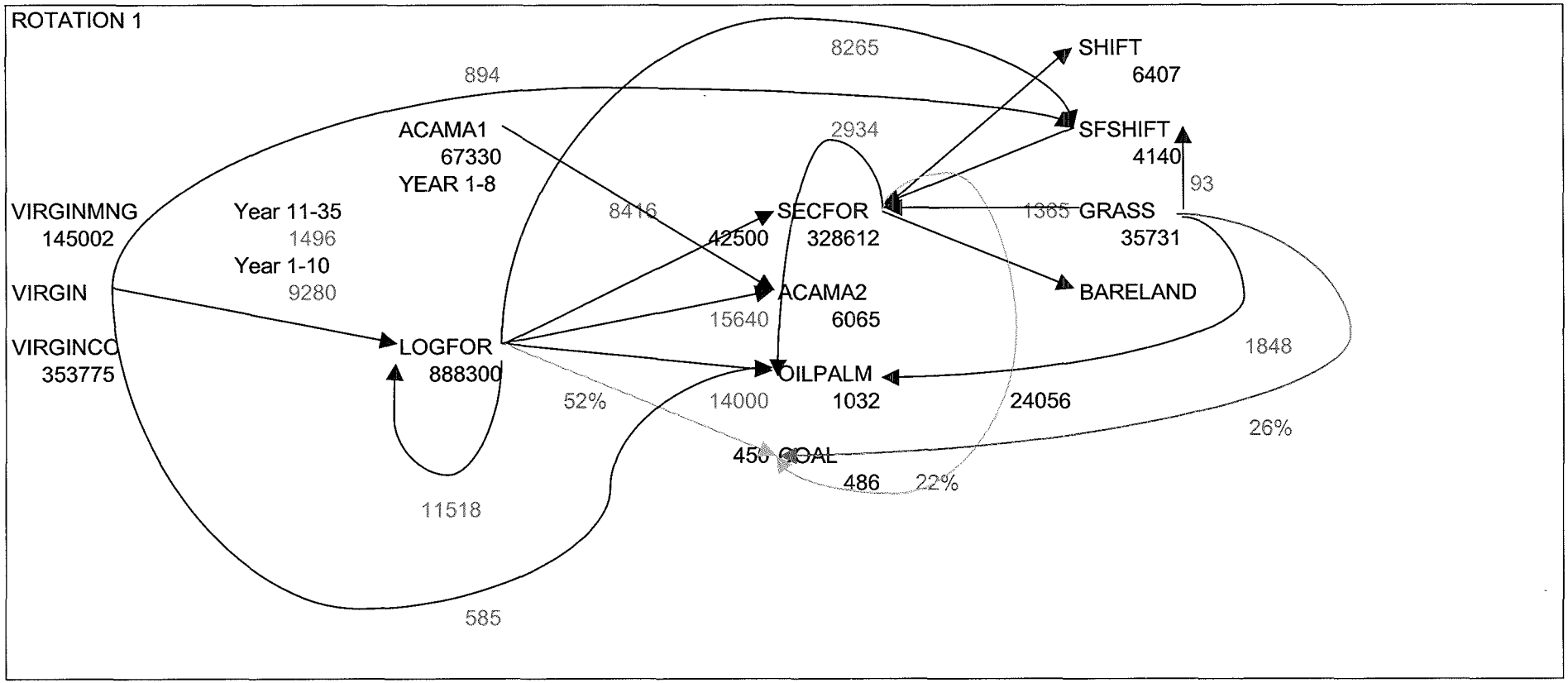


Figure Annex-1. 2: Land use flow diagram in Berau District under District Plan scenario, from 2001-2050

plantation (1,848 ha/year), some into shifting cultivation (93 ha/year) and also for coal mining (around 100-400 ha/year).

As regards the oilpalm plantation, there is great ambition by the District Government for its development. Nearly 20,000 ha/year of new oilpalm plantation is established during the first ten years. They are from formerly virgin forest (585 ha/year), logged over forest (14,000 ha/year), secondary forest (2,984 ha/year), and grassland (1,848 ha/year).

A new feature in this scenario is the introduction of a Non Declining Yield constraint for the production forests (VIRGINMNG and LOGFOR). This is a less strict constraint, as the model allows some optimisation as long as the yield of the two croptypes do not decline. This was assumed to suit the interest of the District Government.

The model for Berau District Government Plan scenario (Annex IV-17) was run in FOLPI. The results were retrieved in Excel spreadsheets using those of the Business As Usual scenario as templates. This results in similar graphs, ready for comparison between scenarios. -2050

c) The Other Six Scenarios

The first two scenarios give a basis for developing the six scenarios contained in Table Annex 1.3 above. For modelling the scenarios in FOLPI, a general guideline was developed. For instance, it was assumed that economically sound scenarios involve a high rate of oilpalm and forest plantations, as data on revenue per hectare shows.

Coal actually gives a high revenue per hectare and so its level of exploitation affects the economic performance of the scenarios. The production level variation, however, is more a subject of environment politics than that of land use planning. Coal production is, therefore, used as an indicator of ecological friendliness. Another feature of ecological friendliness is a lower level of virgin forest conversion, implying that economic production is done on ecologically less valuable land uses such as grassland, secondary forest or logged over forests.

On the social aspect, an indicator of friendliness is the amount of labour required. Consequently oilpalm plantation is more favoured than forest plantation because the former require more labour per hectare in its management. The other indicator assumed for social friendliness is the amount of shifting cultivation involved in the scenario,

because this type of land use cares for poorer people. The general guidelines appear in Table 4.8 in Chapter IV.

The general guidelines were then interpreted for each scenario. For instance, Scenario 1 is economically sound, socially medium, and ecologically poor, which implies unsustainable land use changes. These include extensive disturbance of ecologically valuable forests (VIRGINCON, VIRGINMNG, LOGFOR) to be replanted into plantations (ACAMA, OILPALM) and shifting cultivation (SHIFT, SFSHIFT). Less valuable forest SECFOR is converted into least ecologically valuable land use, the grassland (GRASS). Ecological poorness is also reflected by exploitation of coal reserve to the full extent. Such interpretation was done for the other five scenarios, and the result is presented in Annex IV-18.

The operational steps were then translated into FOLPI language. Again taking Scenario 1 as a start, it was observed that this scenario is similar but more extreme than the District Government scenario. Scenario 1 model was, therefore, based on the District Government scenario. The more extremely high economic feature was translated into increased conversion of VIRGINCON-VIRGINMNG into LOGFOR, i.e. an additional 260,000 ha over the first 20 years of the planning period. Their conversion into OILPALM also increased by around 2,500 ha/year over the first 10 years, but OILPALM replanting from LOGFOR decreased by 7,000 ha/year over the first 10 years. These were to reflect the less job-creating nature of the scenario. Conversion of LOGFOR into ACAMA was increased by around 65,000 ha over the first 20 years of the planning period. LOGFOR conversion into SFSHIFT was decreased: rather than at the rate of over 8,000 ha/year (plus about 600 ha/year from virgin forests) over the first 10 years, it is 1,000 ha/year over the first 20 years, to be continued by its establishment from virgin forests at the same rate over the rest of the planning period.

The modelling instructions were then applied in FOLPI, and the same procedure was applied for the other five scenarios. As with the previous two models, the FOLPI run's results of the six scenarios were retrieved into the same spreadsheet template. This allowed automatic production of graphs of the land use scenarios and the impacts.

The graphs were then evaluated to see if the scenarios conformed to the intended characteristics as described in Table 4.1 in Chapter IV. Table Annex 1.8 is an example of the evaluation process.

Table Annex-1. 7: Evaluation of the impacts trends towards the final version of Case Study's six scenarios

Aspect	Attributes	1	2	3	4	5	6
ECONOMIC	Level	Sound	Sound	Medium	Poor	Medium	Poor
	Gross Revenue maximums (US$ millions)	1350	1100	1000	900	725	725
	Action	No	No	No	No	Increase	No
	Forestry Tax (US$ millions)	60 - 70	50 - 60	60-30-48	35-40-28-35	40 -50	40-35-48
	Action	No	No	No	No	No	No
	Coal Tax (US$ millions)	50	50	50	50	35	35
	Action	No	No	No	No	No	No
SOCIAL	Level	Medium	Poor	Sound	Sound	Poor	Medium
	Labour Requirement (workday millions)	45-35-40	20-17-19	25-20-25	10-8-9	7.5-6-7	10-7.5-9
	Action	No	No	No	Increase	No	Increase
	Shifting Cultivation Area (Ha thousands)	100-40	10.5 – 6	80 – 80	10 – 6	0 – 100 (straight)	1 –100 (straight)
	Action	Reduce	No	No	Increase	Reduce	Reduce
ECOLOGICAL	Level	Poor	Medium	Poor	Medium	Sound	Sound
	Bioindex minimums (thousands)	325	425	375	525	520	520
	Action	No	No	No	Reduce	No	No
	Soilcost (US$ millions)	3.5 - 3 – 3.6	2.7	2.8 – 3	2.1	1.9	1.9
	Action	No	No	No	No	No	No
	Carbon Stock minimums (Ton C millions)	230	280	235	332	335	332
	Action	No	No	No	Reduce	No	No

The models were then improved as necessary and rerun in FOLPI, evaluated again, and further improved until they satisfactorily represented their intended characteristics. When the final versions of the six scenarios were obtained, the model run results, along with those of the Business As Usual and District Government scenarios, were compiled in spreadsheets. They became the data source of numerous graphs on various impacts of the different scenarios.

ANNEX II

FACTORIAL DESIGN AND THE Q STATEMENTS FOR THE TRIAL Q APPLICATION

This table presents the 33 statements used in the trial stage of the verbal Q application, which is discuss in section V.C.1. They were selected from a Q concourse so that each level of definiteness and each element of theoretical completeness were represented. The notes on definiteness are quoted from Coke and Brown (1976).

Definiteness Theoretical Completeness	BIAS (a general preference for a particular interpretation of the facts)	WISH (a desire for a specified end or course of action)	POLICY (a belief as to the best means for achieving valued outcomes)
ECONOMIC	• 33. Human being is most favourable creatures on earth. Therefore most important is people's welfare, and environmental concerns must not be a constraint. • 18. I can not understand why mineral resources can not be mined simply because certain valuable trees are growing on the surface. • 21. Most important is that current and future generations keep prospering. No problem if the environment deteriorates as long as people keep having good source of earning. • 2. Capital intensive companies are better than labour intensive ones because the former are more efficient, hence capable of contributing greater tax money. • 26. Companies need to have enough profits in order to survive and keep contributing to development. Therefore environmental and social expenses need to be minimized.	• 7. More than anything else, in natural resource development we need to have continuous supply of production of timber, oilpalm, etc. Communities' prosperity and environmental sustainability can be considered next. • 10. Local and central governments need revenue to implement their functions. Therefore, support should be given to any business that contribute more revenue to the government. Environmental and social concerns come next. • 26. It is important that private companies gain enough profits in order to keep their existence and contribution to development. Therefore, environmental and social expenses should be minimized. • 6. The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	• 6. The Government must secure that natural resource management businesses can run without too many financial claims from communities. • 13. Natural resources utilization is important for improving people's prosperity. Therefore, the government should give more incentives for investment in this field. • 12. Economic development is a key to people's prosperity. The Government should therefore allow maximum natural resource exploitation. Environmental concern comes next.

Definiteness Theoretical Completeness	BIAS (a general preference for a particular interpretation of the facts)	WISH (a desire for a specified end or course of action)	POLICY (a belief as to the best means for achieving valued outcomes)
ECOLOGICAL	• 19. Regardless of what type of land uses we have – it must enhance the environment • 1. It is wrong to pursue only economic benefits of development. It should be the total economic value, including ecological and social benefits. • 17. The jungle is rich of plants and animals whose uses we don't know yet. It is not right to pursue timber in the expense of their existence. • 32. I am worried that flooding may result from over exploitation of natural resources in this region, as has been happening in many places in Indonesia.	• 11. Our land use plan should leave much forest intact. • 28. Clean water is very important for the local people. Any natural resource development activity must adopt techniques that avoid local water pollution, at any cost. • 8. I have heard of people getting money because their vegetation can absorb carbon. I want to see that happen here in this region. And for that reason I would like to see this area remain richly vegetated. • 25. The forest is a rich source of medicinal plants with potentially great value. I'd like to see the resources preserved by reducing forest harvesting, and then the medicinal value explored to replace the timber value.	• 20. We need to enforce that new forest and agricultural plantations can only be established on lands with little vegetation, not on forested lands that are clear cut for the timber revenue. • 24. Land use plans must assure that such impacts like flooding due to over clearing of forests are avoided. Land uses with high erosion risk must be minimized. • 29. Environmental Impact Assessment has been there to make sure natural resource development is sustainable. Its implementation needs to be strictly enforced. Severe sanctions need to be applied for any violation.
SOCIAL	• 15. It's all very well having modern natural resource development, but if local people don't benefit it's no good. • 27. I think companies operating natural resource utilization have not contributed enough of their profits to the government and communities. • 5. People need to earn good living. Where there is no alternative source of living, such local people activities like unsustainable shifting cultivation and illegal logging should be allowed as long as they are not commercialised by investors. • 14. It doesn't matter how profitable a resource management activity is. More preferable is the one employing more people.	• 9. Local communities should enjoy more benefits from natural resources utilization. • 3. They say this region is rich in natural resources. I would like it reflected in the welfare of the people. The benefits need to be distributed in a more appropriate manner. • 22. Proper shifting cultivation is sustainable and suitable for many people in the rural areas, and so it should be maintained and even further promoted.	• 4. Companies should be required to employ more local people. They should also spare special budget for training the locals so they are up to the job. • 16. The government must make sure that companies' community development programmes do improve people's prosperity. • 31. As an incentive against short fallow shifting cultivation, land title should be granted for farmers practicing sustainable shifting cultivation. • 23. For the sake of people's prosperity, labour intensive companies should be given more support than the capital intensive ones.

ANNEX III

FACTORIAL DESIGN AND THE Q STATEMENTS FOR THE MAIN Q APPLICATION

This table presents the 22 statements used in the verbal Q application, which is discussed in section V.C.2. They were selected from the 33 statements in Annex III in order to be more manageable for the respondents to sort.

Definiteness Theoretical Completeness	BIAS (a general preference for a particular interpretation of the facts)	WISH (a desire for a specified end or course of action)	POLICY (a belief as to the best means for achieving valued outcomes)
ECONOMIC	• 2. Human being is most favourable creatures on earth. Therefore most important is people's welfare, and environmental concerns must not be a constraint. • 4. Companies need to have enough profits in order to survive and keep contributing to development. Therefore environmental and social expenses need to be minimized.	• 5. More than anything else, in natural resource development we need to have continuous supply of production of timber, oilpalm, etc. Communities' prosperity and environmental sustainability can be considered next. • 8. The more money involved in those activities, the more the district will prosper. Therefore, big companies should be supported.	• 6. The Government must secure that natural resource management businesses can run without too many financial claims from communities. • 7. Natural resources utilization is important for improving people's prosperity. Therefore, the government should give more incentives for investment in this field. • 1. Economic development is a key to people's prosperity. The Government should therefore allow maximum natural resource exploitation. Environmental concern comes next.
ECOLOGICAL	• 13. I am worried that flooding may result from over exploitation of natural resources in this region, as has been happening in many places in Indonesia.	• 9. Our land use plan should leave much forest intact. • 16. Clean water is very important for the local people. Any natural resource development activity must adopt techniques that avoid local water pollution, at any cost. • 10. I have heard of people getting money because their vegetation can absorb carbon. I want to see that happen here in this region. And for that reason I would like to see this area remain richly vegetated.	• 21. We need to enforce that new forest and agricultural plantations can only be established on lands with little vegetation, not on forested lands that are clear cut for the timber revenue. • 20. Land use plans must assure that such impacts like flooding due to over clearing of forests are avoided. Land uses with high erosion risk must be minimized.

Definiteness Theoretical Completeness	BIAS (a general preference for a particular interpretation of the facts)	WISH (a desire for a specified end or course of action)	POLICY (a belief as to the best means for achieving valued outcomes)
ECOLOGICAL (continued)	•	• 15. The forest is a rich source of medicinal plants with potentially great value. I'd like to see the resources preserved by reducing forest harvesting, and then the medicinal value explored to replace the timber value.	• 22. Environmental Impact Assessment has been there to make sure natural resource development is sustainable. Its implementation needs to be strictly enforced. Severe sanctions need to be applied for any violation.
SOCIAL	• 11. It's all very well having modern natural resource development, but if local people don't benefit it's no good. • 3. People need to earn good living. Where there is no alternative source of living, such local people activities like unsustainable shifting cultivation and illegal logging should be allowed as long as they are not commercialised by investors.	• 14. They say this region is rich in natural resources. I would like it reflected in the welfare of the people. The benefits need to be distributed in a more appropriate manner.	• 12. Companies should be required to employ more local people. They should also spare special budget for training the locals so they are up to the job. • 18. The government must make sure that companies' community development programmes do improve people's prosperity. • 19. As an incentive against short fallow shifting cultivation, land title should be granted for farmers practicing sustainable shifting cultivation. • 17. For the sake of people's prosperity, labour intensive companies should be given more support than the capital intensive ones.

ANNEX IV

AN EXAMPLE OF THE GRAPHICAL Q CARD

SCENARIO 1 (2001-2050)

VIRGIN FOREST IN 2000: 500 000 ha
— Production forest: 30.000 ha becomes oilpalm plantation; 30.000 ha selectively cut
— Conservation forest: 30.000 ha becomes short-fallowed shifting cultivation; 260.000 ha selectively cut

LOGGED OVER AREA: 888.500 ha
— 192.000 ha becomes for. plant.
— 70.000 ha becomes oilpalm plant.
— New LOA from conserv. virgin for. At 13.000 ha/yr from yr 1-20
— New LOA from production virgin for. at 10.000 ha/yr from yr 1-10

SECONDARY FOR. in 2000: 330 000 ha
— annually 2.000 ha becomes grassland
— annually 4.000 ha selectively cut
— annually 2.000 ha new, from LOA

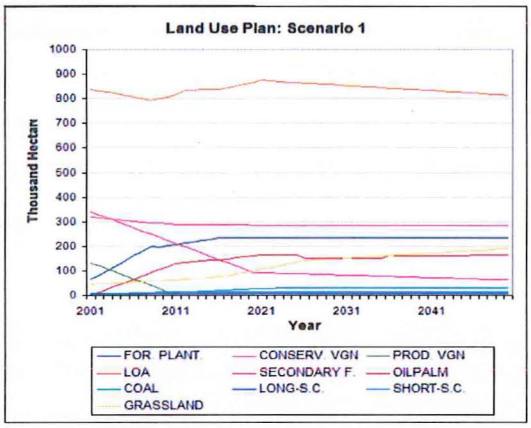
FOREST PLANT. in 2000: 73 500 ha
— existing 73.500 ha plus 192.000 ha from LOA

OILPALM PLANT. in 2000: 1.000 ha
New plantation 130.000 ha:
— 30.000 ha from production virgin for.
— 70.000 ha from LOA
— 30.000 ha from secondary forest

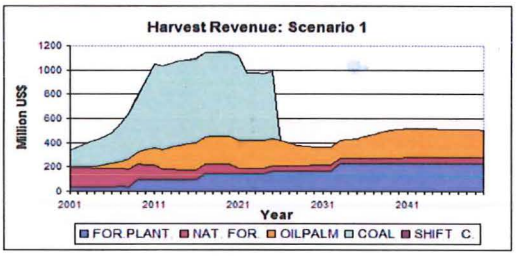
SHIFTING CULTIVATION: in 2000: 6.400 ha
long-fallowed + 4.100 ha short-fallowed
— the long-fallowed unchanged
— the short-fallowed increase 1.000 ha/yr from LOA and 1.000 ha from conservation virgin forest

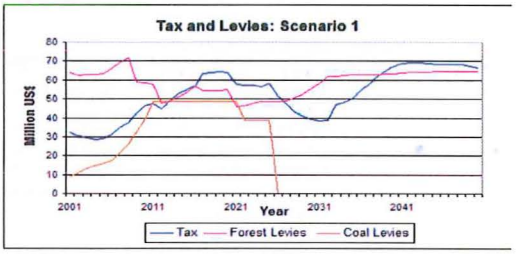
COAL in 2000: 500 ha
— all reserves are mined in 25 years.

GRASSLAND: in 2000: 85.000 ha
— some coal mining

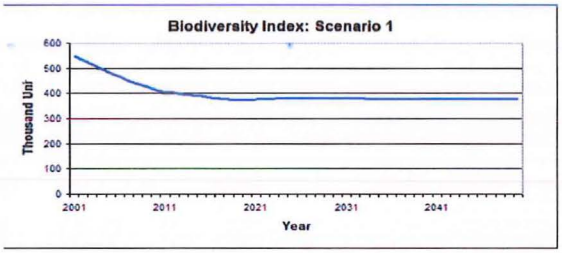


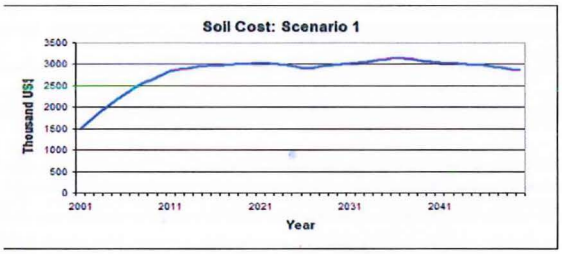
ECONOMIC IMPACTS

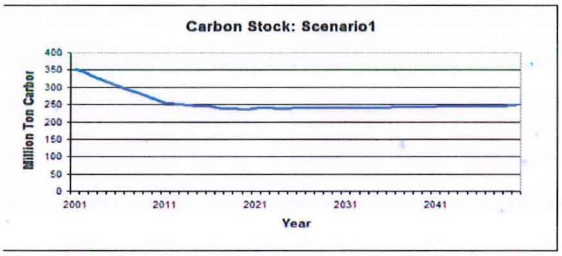




ECOLOGICAL IMPACTS







SOCIAL IMPACTS